Reconfiguring clinical theory and practice: exploring the impact of virtual reality learning environments on holistic healthcare education.

By

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Dedication

In memory of my brother Jia.

Deeply loved.

Abstract

This thesis is the first detailed exploration of the impact of profession generic and topic specific virtual reality learning environments (VRLE) on holistic healthcare education. These VRLE have a focus on skills required for humanisation of care and the development of clinical intuition when practising clinical skills within the VRLE.

Background:

Healthcare pedagogy prepares future professionals to work in a highly skilled, caring and compassionate way. However, the complexity of supporting students to develop holistic healthcare skills is compounded by an inability to guarantee availability of all clinical care experiences for each student. Equally important, students need to be able to learn at their own pace with varying numbers of opportunities to apply theory to clinical practice, if they are to maximise their potential as individuals

Methods:

This research involved 311 research participants (RPs) who are healthcare students from various healthcare professions from all levels of degree study at a UK Higher Education Institution. Action research, using mixed methods viewed through a phenomenographical lens, generated findings that reflect the triad of love, art and science linked to healthcare. Data was collected pre- and post-action using online questionnaires and post-action online focus groups.

Results:

Positive benefits were apparent in relation to offering space to learn and practice clinical skills. Physiological and psychological reactions to the VRLE scenario were reported by most RPs. The connectivity and functionality were noted to have a negative impact for RPs though solutions can be readily implemented. VRLE offered a space for healthcare students to learn, practice and collaborate in interprofessional and multidisciplinary ways, thusly achieving experiences which they may not have otherwise been able to benefit from.

Conclusions:

The research findings demonstrate that there is a place for VRLE within healthcare pedagogy and assessment, though the functionality and connectivity must be reliable to offer the optimum experience. VRLE offer a unique way to maximise gains from practice opportunities. They also support bridging the theory-practice gap particularly for refreshing clinical skills confidence or to explore new skills. VRLE support use of

clinical intuition including learning ways in which it can be used as part of the clinical skillset necessary for holistic healthcare.

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Chapter One: Introduction

"…. Love and science are the two most important things. The skills you have and build on are fundamentally important, but the kindness and the compassion you show will make the difference. More often than not you will be an uninvited guest into a sacred space where people are vulnerable. What you do and how you do it, what you say and how you say it may be remembered for the rest of their lives."
Byrom (2018)

1.1 Legislation and standards for healthcare education and healthcare professionals

The higher education (HE) of nurses and midwives continues to be recognised to be of significant importance for betterment of women and children's health and there are national and international policies and guidance specific to these matters (World Health Organisation [WHO] 2015a, Renfrew et al. 2014, United Nations 2015; Fullerton et al. 2019; Nursing and Midwifery Council [NMC] 2023a). Prior to 2023 EU Standards were included in the Nursing and Midwifery Council regulations but now pre-registration ongoing proficiency standards are set solely by the NMC. This includes consideration of how simulated practice can be increasingly used to support education (West 2023). Implementing global standards for nursing and midwifery education was first raised by the WHO (2015a) and driven forward for midwives by the International Confederation of Midwives (ICM 2013). The standards are an expectation of the minimum acceptable level of education for nurses and midwives and will allow for adaptation to meet cultural needs (NMC 2023a). Minimum essential standards for clinical practice education for other health professions are also in place (Hogard et al. 2018; Reed et al. 2019; Reid et al. 2019; Twose et al. 2019).

These standards facilitate working to the expectation of governing bodies of the individual healthcare professions but do little to indicate how the different professions can work most effectively together to deliver holistic healthcare. Thusly healthcare students benefit from interprofessional education units which encourage collaborative projects as well as other techniques to guide them into determining how to work together when required (Lapkin et al. 2013; Aldriwesh et al. 2022; Törnqvist 2023). Despite this there is very little research that considers the collective opinions of interprofessional healthcare students in relation to pedagogical initiatives that support them to learn as individuals and collaboratively, interchangeably, depending on the learning required. This research takes that step and will contribute to the knowledge base about impact on the general healthcare student population when using Virtual Reality Learning Environments (VRLE) to support students to develop skills for person-centred holistic care.

1.2 Personal motivation for this research

In 2009 the world was gripped by the pandemic caused by the H1N1 virus which was more commonly known as the swine flu. It impacted the UK healthcare workforce on a level my generation of public health, education and healthcare professionals had not yet experienced (Department of Health and Social Care [DHSC] 2010; Chambers et al.

2012). At that time, I was working part-time in two jobs: as a lecturer in midwifery and in the infectious diseases outbreak team of the public health department. Due to the increased pressure on the public health team permission for secondment was requested and granted for me to temporarily switch to working full time for the public health department. This unfortunately meant that the specialist subjects I was scheduled to teach during this time had to be delayed until the pandemic ended and I was able to return to teaching.

It occurred to me that if there was an alternate way to deliver healthcare education in circumstances such as these or in the case of staff or student sickness for any reason, then this would likely be of value for all concerned. When I returned to teaching after the H1N1v pandemic I developed my first alternative educational option which was a web based standalone distance learning module for maternal and childhood obesity (MaCO). This was used by undergraduate healthcare students of various professions (Appendix 1). The MaCO package was sold by Bournemouth University (BU) as continuing professional development (CPD) at undergraduate and Master's level via distance education for public health staff, healthcare workers and qualified healthcare professionals (Wessex Academic Health Science Network ND) as well as part of the Healthy Pompey project (Appendix 1).

The success of this work then led on to me being commissioned by Health Education England (HEE) to write content for an obesity app (Appendix 2). By this point I was invested in continuing to develop learning packages that could withstand the impact of staff or student absences and any future pandemics (MaCO resource 2013; King et al. 2018). History, when viewed as a continuum, has shown that change is the one thing that is guaranteed in healthcare education (Karia et al. 2019; Ramani et al. 2019; Shaw et al. 2020).

1.3 Legal and socio-political background

A little over 150 years ago, Florence Nightingale in her role as a healthcare educator changed healthcare in the most impactful way, simply through the introduction of mandatory hand hygiene. Yet this was seen as an unnecessary implementation by many who, it could be argued, were more short-sighted and inflexible (Gilbert 2020; Hillier 2020). In more recent history the NHS bursary reform stopped offering bursaries to nursing and midwifery students from England in 2017 which could also be argued to be short-sighted in relation to the NHS staffing resource (HEE 2019; NHS 2023). This short-sightedness can particularly be recognised when taking into consideration the

fact that the expectations for student nurses, midwives and paramedics to undertake hundreds of unpaid compulsory clinical practice per year alongside learning theory did not reduce when the bursary was stopped (NMC 2009, NMC 2019, NMC 2023a). Therefore, nursing and midwifery students who were not able to fund their education through other means had to rely on student loans. Along with healthcare education for other professions such as health visiting, physiotherapy and paramedic science, this risked marginalising and preventing debt adverse students from being able to benefit from a university education (Haliwell 2016; Sayburn 2016).

This removal of the bursary resulted in a notable drop in applications until a maintenance grant was introduced in 2019 after which applicant numbers began to rise (18% in 2020) but have still not returned to their pre-2017 numbers and early data from 2023 has shown a significant decrease in home applicants for nursing (20%) and midwifery (22%) (Lewis et al. 2023). Medical and dental students continue to be eligible for a bursary from the fifth year of study on a five- or six-year education programme (British Medical Journal [BMJ] 2022; NHS Business Authority Services ND). However, these professions face educational challenges of their own (Caverzagie 2017; Althwanay et al. 2020).

Figures demonstrate that there has been a change in the age demographic of healthcare students applying to Universities in England since changes to university fees and funding were made (Hubble and Bolton 2021). Applications for HE fell across all age groups (Home and EU) between 2017 and 2023, except the 18-year-old population which saw an increase (37.5% in 2022) despite the drop in total numbers of 18-year-olds in the UK (Bolton 2023). University applications otherwise were noted to decrease as the age of the applicant increased. Interestingly, Canning (2017) argues that student loans should empower the student voice as the commissioners of the services universities provide. It has been argued that the increasing proportion of digital generation students have an expectation that their higher education institutions evidence they have kept pace with technological progress and that that this progress is accessible as part of their pedagogy (Benavides et al. 2020). Additionally, the importance of higher education institution's educators being not only competent in digital technology but also positive about use of these resources has been raised (Nunez-Canal 2022).

1.4 The need for flexible pedagogy

In healthcare education much of the learning at early stages of introduction to new skills is vicarious, during which the healthcare students observe demonstrations of how to apply the theory to clinical practice (Kent et al. 2020). This occurs both through classroom simulation and whilst on placement in clinical practice. It has been suggested that students fit into one or more of the following learning styles: visual, aural, reading / writing or kinesthetic (Flemming and Mills 1992). It is clear to see the challenges presented when trying to engage all preferences in learning styles, yet it is important that this is comprehensively done to maximize the benefits of the learning session whether in class or while on clinical practice placements. The NMC (2023) has recognised the value simulation can bring to clinical practice learning sessions and there is expectation that healthcare education programmes look into how this can be used more flexibly, for example as a way to make up missed clinical practice. Furthermore, there are frameworks which specify that an individual is expected to practice autonomously within strict professional boundaries that encompass everything from professional practice to professional identity (NMC 2023b, UKPHR 2020, Health and Care Professions Council [HCPC] 2021). Another important consideration is the complexity of supporting individuals to learn how to *become* healthcare professionals as opposed to simply learning what is the *expected* behavior of someone providing healthcare (Walsh 2006; Dall'Alba and Barnacle 2007; Lawson 2016; Rosewilliam et al. 2020; Cook et al. 2022).

1.4.1 The triad of love, art and science in healthcare

The quote by Byrom (2018) at the start of this chapter resonates with me as a healthcare professional and as an educator of student and future healthcare professionals. Byrom (2018) refers to compassion and kindness as skills and love being as important as science. However, as a healthcare professional I would argue that love is also an essential skill for effective healthcare and healthcare education. Many healthcare professions refer to their discipline of healthcare as both an art and a science (Power 2015; Diretee 2016; Taylor et al. 2018) and it has been argued that this should be an expectation of all healthcare professions (Tuton 2012).The connection and importance of love to holistic humanised healthcare and healthcare education is clear even within each of the 6 Cs building blocks which are defined as care, compassion, competence, commitment, courage, communication (DHSC / NHS Commissioning Board 2017). Furthermore, the links of art and science to healthcare and healthcare education are apparent when individual healthcare professionals provide evidence-based healthcare and when professions work as autonomous practitioners whilst collaborating as part of the wider healthcare workforce for the betterment of the person needing each healthcare episode (Dobkin 2020). Whether

one chooses to label the outcome as; holistic healthcare, humanisation of healthcare, person-centred healthcare or the 6 Cs of healthcare, the fact remains that student and future healthcare professionals need to learn from a curriculum that has the triad of love, art and science threaded throughout each topic. The irrevocable links of this triad to the gold standard of healthcare are highlighted throughout this research and woven into the fabric of this thesis.

1.4.2 Humanisation of healthcare

People requiring healthcare are referred to in various ways in the clinical environments. These include words such as patients, women, mothers, and clients. These titles are dependent on the type of healthcare being provided. For equity throughout this thesis, they will be referred to as clients by the author. Billet (2016) emphasizes the importance to healthcare students of being able to understand the perspectives of people receiving the healthcare and argues that this increases the student's motivation to apply themselves to their theoretical learning related to clinical practice. It can be argued that this is the same for all healthcare students as the humanisation of healthcare is crucial for the benefit of those who receive it and those who provide it (Todres et al. 2009; De la Fuente-Martos et al. 2018). Andrew et al. (2009) highlights the importance of healthcare students forming identification with their role in practice from an early point in their education so that they understand their role within their chosen profession. Understanding how to humanise healthcare is a journey that every healthcare student needs to make and the ways in which they develop this skill will vary because although the importance of it is undisputed, there is no straightforward process with which to do so (Busch et al. 2019).

Indeed, the lack of healthcare education that includes humanisation focused learning, particularly that which includes use of digital technology, has been highlighted in a recent systematic review by Gonzalez-Mreno et al. (2023). These researchers have recommended development of education that incorporates tools to development humanisation of care skills. Stress, lack of equipment and staffing resources are reconised as common limiters in the ability to offer humanised care (De la Fuente-Martos et al. 2018). In an effort to prevent humanised care becoming a term only synonymous with low-risk healthcare it can be argued that developing skills to navigate provision of humanised care even in difficult workplace circumstances should be a key educational priority in order to improve healthcare episode outcomes for clients, students and healthcare professionals (Molero Jurado et al. 2021).

Key aspects that define humanisation of healthcare have been determined. The 6 Cs are stated to be key components which aid humanisation of healthcare (DHSC / NHS Commissioning Board 2017). It is clear that treating the client as an individual, accepting their autonomy, ensuring their dignity is preserved and not treating them just as a collection of symptoms is important but there is a need to look beyond these factors (Busch et al. 2019; Curtain et al. 2022). The meaning and provision of humanisation of healthcare can vary depending on the situation, which further increases the difficulty in supporting healthcare students to learn how to incorporate it into their portfolio of healthcare skills (Curtain et al. 2019). It is clear that humanisation of healthcare requires an understanding of what the client requires from a holistic standpoint, including problems or needs which they may not feel able to or be capable to voice (Basile et al. 2021; Neilsen et al. 2021). Thusly the healthcare professional needs to have an awareness of what the client is communicating verbally and non-verbally (Clark and Watts 2021; Ahmad et al 2023). In some cases, this needs to happen rapidly and intuitive inferences may need to be made (Taggart et al. 2021). One of the ways this can happen is by use of clinical intuition (Gordon 2020; Dickens et al. 2023) which is sometimes referred to as 'gut instinct' or something setting off 'alarm bells' (Jackson 2022; Peterwerth et al. 2022). Within this research these terms are used interchangeably.

1.4.3 Clinical intuition

There have been a number of notable research projects which concluded that the importance of clinical intuition, as part of the gold standard of holistic healthcare, cannot be over emphasized (Fry 2012; Cork 2014; Melin-Johansson et al. 2017; Silverwood et al. 2019). In addition to this there has been some debate about the value of clinical intuition as a clinical skill (Roberts 2015; Sheikh and Mugele 2021). However, there is agreement that recognition of the sensation of clinical intuition can serve as an indicator to begin analytical reasoning about the clinical presentation (Rew 2000; Anderson et al. 2019; Emery 2021). Recent research has indicated that clinical intuition may be simply the brain recognising and combining the measurable and unmeasurable, verbal and non-verbal presentation of symptoms and translating this rapid progress into a physiological sensation in the first instance (Vanstone et al. 2019). Others agree and state that this in itself can be advantageous if it leads the healthcare professional to provide more rapid care (Smith et al. 2020). Therefore, it can be argued that the earlier research which concluded that intuition is a valid form of knowledge utilisation and necessary for holistic healthcare have been upheld by more recent research.

Despite this, tensions persist and the value of intuitive clinical practice continues to be met with opposition and is subject to ongoing debate. There is concern that intuitive practice, even when used in combination with other clinical skills, has been devalued due to the push to move towards more risk-adverse clinical practice (Peterwerth et al. 2020; Renfrew et al. 2020). A recent systematic review of multidisciplinary clinical practice acknowledged the need for recognition of the place intuitive clinical practice occupies in holistic healthcare and that without this the benefits it could provide as part of a wide range of clinical skills are limited (Lame et al. 2023; Shorey and Ng 2023). The suggestion that clinical intuition should not be the singular definitive diagnostic tool is a valid one, however recognition of the value it brings for gaining deeper awareness of things which can be sensed but not always measured is also important (Miller and Hill 2018; Van den Brink et al. 2019; Jackson 2022). There are in fact, a wide variety of such things commonly referred to as prodromes or prodromi which are accepted as valuable indicators of a need for healthcare (Leibovich-Nassi and Reshef 2021; Marrie et al. 2022).

To clarify, a prodrome can be felt or sensed by the individual and is recognized to be common in certain clinical conditions such as viruses, syncope, epilepsy, migraines, myocardial infarction, sepsis and anaphylaxis (Cubera et a. 2017; Besag and Vasey 2018). Prodromes can present in a wide range of ways including pain, anxiety, fatigue, visual disturbances, nausea, sense of impending doom, dizziness and more all of which warn the person of an impending exacerbation of their condition (Blakeman et al. 2020; Ring et al. 2021; Tremlet et al.2022). Although a self-reported or described sense of prodrome often cannot be measured by the healthcare professional, it is nonetheless accepted as a valuable indicator (Cuvellier 2019; Leibovich-Nassi and Reshef 2021). Clinical intuition can manifest in a similar way and is of similar value, especially when clinical intuition is frequently reported as a bodily or emotional sensation (Kosowski and Roberts 2003; Smith et al. 2020).

Interestingly it has been suggested that there may be a difference in reliability of clinical intuition depending on the healthcare discipline with suggestion that midwives may experience intuition linked to physiological processes and medics may experience intuition linked to pathological ones (Lambrechts et al. 2019). However, others express concern that this may stereotype healthcare disciplines and caution that clinical decision making is complicated for all healthcare professionals and the methods used will vary dependent on the clinical circumstances, clinical confidence and competence of each individual amongst other factors (Jefford 2019). On balance, it can be argued that wider acceptance of clinical intuition's worth as an indicator to events which may

not be easily measurable, will encourage the use of this skill as part of a wide range of clinical skills including those required for rapid clinical decision making.

Along with use of clinical intuition for routine care in order to pick up on hidden or inexpressible indicators of complex conditions (Adam and Dempsey 2020; Smith et al. 2020; Davison 2021), clinical intuition can be particularly useful in unexpected circumstances such as safeguarding situations (Erisman et al. 2020) and during urgent care or clinical emergencies (Valenzuela 2019). I would argue that by early recognition of, and action towards resolving, ill-health conditions noted through clinical intuition we are further able to evidence our desire to provide humanized care. Personal professional experience has shown that healthcare can also be humanised without the use of clinical intuition. However, when both are used for healthcare, along with partnership in care planning between the patient and wider healthcare team, they become something more than the sum of their parts known as person-centered care (Ekamn et al. 2011; WHO 2015; Collington and Fook 2019).

1.4.4 Person-centered care

The value of person-centered care is supported in the literature in various healthcare professions' perspectives from emergency care to midwifery (Dean and Major 2008; Curtain et al. 2020). It can be argued that this identification and ability to humanise their healthcare as well as utilise their clinical intuition is a key learning acquisition for healthcare students in order to prevent it becoming reduced to a skill only used by expert practitioners (Phelan et al. 2020). Frequent opportunities to practice humanisation of healthcare and clinical intuition, along with other skills, will facilitate acknowledgement, acceptance, adaptation and application of holistic healthcare skills to the demands of their professional responsibilities as student and future healthcare professionals (Turan et al. 2019). However, the necessary frequent practice opportunities cannot be guaranteed in the current healthcare pedagogy. Nor can they be provided on demand, which unfortunately means that students who wish to have additional practice are not always able to do so. This research focusses on the exploration of the research gap of healthcare students having the opportunity to develop person -centered care skills through use of VRLE for learning theory and clinical practice.

1.4.5 Pedagogy for student and future healthcare professionals

As previously noted, healthcare students differ widely in their enthusiasm for learning theory, from those who are keen to engage with all aspects of their training to those who feel more comfortable applying themselves to the practical side of learning. Both aspects are equally important and it is key that educators are able to support

healthcare students to fully immerse themselves in their training as a whole (NMC 2023b). Hodson (1998) argues that by scaffolding educational experiences, students are better able to associate the relevance of theory to practice. Both the clinical practice supervisors and academic educators need to ensure students are able to make connections between theory and practical learning (NMC 2023b). In aid of this students must be offered ways to tackle any barriers limiting their opportunities to translate newly learned theory principles into actual practice.

The educator needs to ensure students are able to make connections between theory and practical learning. Students must be offered ways to tackle barriers to translating newly learned principles into actual practice, or in other words a way to bridge this time lapse between theory and clinical practice. Kang et al. (2017) states that we are moving into the 4th industrial revolution and need to change our focus in education from the teacher as the expert with students as passive learners who develop basic skills, to recognising that healthcare students and professionals are lifelong learners who want personalised education which will develop them holistically. Additionally, they want this education to be accessible from anywhere, using any device to support active exploratory learning.

As discussed in the personal motivation section (section 1.2), there is a responsibility for education providers to ensure that learning can continue even in the most challenging circumstances as well as offering healthcare students learning opportunities which cannot otherwise be guaranteed. This not only provides student satisfaction but also continues to develop healthcare professionals suitably qualified to join the healthcare workforce. With the changing way in which healthcare is being offered and delivered, including use of robotics and artificial intelligence (AI), a new paradigm for learning must be developed to prepare the future workforce (NHS England 2019; Topal 2019). This will ensure that healthcare students are supported to learn how to provide holistic healthcare with all available technology both now and in their future professional practice. In order for these student and future professionals to be competent they must be able to access healthcare experiences to use for clinical practice development and as discussed there are many which cannot be otherwise be guaranteed during their healthcare education such as safeguarding, urgent and emergency care experiences.

1.5 Rationale for using virtual reality learning

Students prefer to learn in a variety of ways and historically this has posed challenges for educators when developing content that is equitable for all learners. The current

legal, socio-cultural, political and economic issues have changed the student demographic and expectations, which has created a new culture within the classroom and the clinical arena. Virtual Reality Learning (VRL) is a technology which can be offered as one of a range of educational tools used within curriculums to support individuals as learners within epistemological and ontological frameworks. It may also open doors for those who would be unable to attend learning sessions in person. Finally, having another option such as VRL, which does not require contemporaneous teaching support, offers opportunities to release staff from teaching commitments to engage in other aspects of academic workloads. Using traditional teaching methods, the leaners experience the same educational content in different ways, and yet most still reach the same end point of graduation from their chosen course of study. This lends support to the concept of offering more virtual options for learning and indeed may even improve outcomes as it adds to the tools available for selection based on learning preference (Tzenious 2020).

Digital technology is increasingly being used for education in healthcare (Gentry et al. 2019). Digital storytelling, interactive electronic platforms, online classrooms, augmentation, attendance registers and more have modernised healthcare education. Many of these advances have been driven forward by the Covid-19 pandemic (Vargo et al. 2020). Therefore, the need for future healthcare students to be digitally literate is important for the future of healthcare (Topal 2019). Many of the high-fidelity simulation mannikins (HFSM) models function at peak performance when their use is enhanced with digital support such as using a mobile device to trigger changes to the mannikins simulated deteriorating health or augmentation of aspects such as facial expression for which handheld tablets are required (Zackoff et al. 2021; Carey and Rossler 2023). There are additional aspects to consider in relation to the overall value of HFSM.

As discussed in the legal and socio-political section (1.3), healthcare students are comprised from a range of demographics including mature and younger learners and it could be argued that this may have an impact on acceptance of VRL experiences. However, Keskitalo (2012) explored the experience of 97 healthcare students and concluded that older learners seemed to have higher expectations of the virtual experiences and from the educators than the younger learners, but that these expectations were easily met. Overall, they recommended that special attention should only be paid to students individually rather than as a chronological cohort. Charalambos et al. (2004) claim this can be exemplified by arguing that restricting students' learning to that of a classroom only environment will not recognise or meet

the full range of students' learning styles nor offer them the most opportunities for engagement with their learning.

The use of HFSM which are currently in use in many healthcare programmes are costly, with initial purchase and set up in the five-figure range, a limited life to the parts which shortens in direct proportion to the number of times it is used, and significant expense attached to replacement of out of date or damaged equipment (Ferguson 2014, Lapkin and Levett-Jones 2011). The cost to build VRLE may be comparatively high for the initial design and build – the concept testing VRLE for my research project cost £4,500 - but the on-going costs for routine maintenance can be regarded as minimal in comparison with on-going maintenance costs of high-fidelity simulation mannikins, particularly if the VRLE product can be used for students of multiple healthcare professions (McGrath et al. 2017; Sankaranarayanan et al. 2018).

Furthermore, the VRLE facilitates and supports the learning of 50 or more students at a time that can be in different parts of the world (Daden 2014), with no requirement for lecturer engagement, compared with a maximum of six learners plus one lecturer when learning skills using a HFSM. Developing VRLE for use in healthcare education is of value - despite being technically complex and as a result often costly (Coban et al. 2015, Kim et al. 2017). So, although the cost to build VRLE may be relatively high for the initial design and build, it is predicted that as the use of VR in education increases in use and sustainability, these costs will invariably reduce (McGrath et al. 2018).

The obsolescence of VRLE is an acknowledged cost implication and the same can be said to be true of HFSM which is why this should be a factored into long term planning for these forms of pedagogy (Vergara et al. 2020; Sanchez et al. 2023). Within VRLE there is the advantage of access to text based factual teaching alongside the opportunity to practice the relevant skills and receive targeted, personalised feedback based on the students' answers and to offer this to potentially limitless number of students simultaneously. Therefore, it can be argued that developing VRLE for use in healthcare education is of value, despite being technically complex and as a result often costly (Kim et al. 2017, Coban et al. 2015).

Another advantage of using VRLE is that whereas face-to-face (F2F) learning using HFSM limits the possibility of sharing excellent teaching on a wider national and international basis, which disadvantages students who would otherwise benefit, VRLE can be accessed on a much wider scale. WHO (2019) have highlighted that learners globally have limited access to HE and educators internationally lack skills and

necessary equipment plus a lack of access to practical skills teaching and interprofessional learning. The benefits of offering real time space for distance learning can be easily imagined, however the realisation of being able to offer this to students needs further consideration as there are a myriad of aspects which could hinder this. Pottle (2019) was clear that VR can successfully provide distance learning for physical clinical skills and suggests that this will soon be part of mainstream pedagogy. Regami and Jones (2020) highlighted that troubleshooting for learners who require individual support to fully participate could pose unique challenges.

Another important consideration is whether VR can be of benefit for distance learning. Cooper et al. (2017) surveyed learning gains comparatively between 5,511 student and qualified nurses from 20 countries and concluded that e-simulation had benefits to offer irrespective of level of study and there seemed to be minimal areas globally where participants were unable to access the learning materials. In Kyaw et al.'s (2019) literature review on use of VR for health education related to clinical and surgical skills, they found that that there was a paucity of research conducted in low to middle income countries and stated that this is where innovative educational strategies are particularly required. Since then, Subedi et al. (2020) have investigated technical problems linked to use of VR. They found that countries in the Global South in particular struggled with this due to the infrastructure of their Internet bandwidth. It is clear that this might limit VR learning opportunities in that part of the world. Meeting the diverse learning needs of large cohorts of the healthcare students of today on a global scale requires innovative and pedagogically informed revolutionary solutions to the above problems.

After reviewing the literature and considering where the research gaps aligned with my areas of interest, the focus of this research has been narrowed to the following three research questions:

1. What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?
2. To what extent does healthcare students use of VRLE impact on the humanisation of their healthcare?
3. To what extent does the VRLE functionality impact healthcare students' perception of their ability to engage with the given scenario?

1.6 Structure of this thesis

This introduction chapter has provided an overview of the motivation for this research, the impact of legal and socio-political reforms, need for flexible pedagogy and consideration of what challenges are associated with modernising healthcare education. Chapter Two explores the existing literature relevant to use of VR in healthcare education. This includes relevant literature about the different contexts VR is used in healthcare education, what the findings were and what gaps there are in research into this subject. Chapter Three introduces the VRLE and discusses the historical perspective of virtual reality (VR) and virtual worlds (VW). The situatedness of VRLE within healthcare education is considered and discussed in comparison to the use and cost of HFSM. Chapter Four contains the research design, methodology and underpinning philosophy. This includes a rationale for the pragmatic use of both quantitative and qualitative data collection and the benefit of this mixed methodology. Ethics and recruitment are also discussed in this chapter. Chapter Five discusses the planning, creation and structuring process of the VRLEs I created for this research. This includes the importance of including aspects of the design which were intended to explore whether VRLE could contribute to development of humanisation of healthcare and clinical intuition. In this regard what VRLE can contribute to the existing educational resources is also discussed. Chapter Six is comprised of the quantitative design and content, followed by the data analysis and discussion of the findings. Chapter Seven focusses on the qualitative data thematic generation and analysis. The themes are discussed in relation to connectivity with the quantitative data and the implications arising. Chapter Eight provides discussion about the thematic connectivity to the research questions, relevance to healthcare education, lessons learned and recommendations for future research.

1.7 Chapter summary

The changes in the student demographic and learning expectations has created a new culture within the classroom and the clinical arena. There is a notable increase in demand for modernisation of healthcare education. The educational experiences, role and professional identity of healthcare students are irrevocably linked and therefore inherently important when considering ways in which healthcare education can be reconfigured through use of VR simulation. It is important to consider the formation of professional cultural identity related to shared values and norms of healthcare professions. Equally key is understanding the need for relevance of all learning sessions from the start of undergraduate healthcare education an essential consideration to factor into the creation of VR simulations. This will help prevent

creating learning spaces which are technical procedure focussed and therefore not relevant to holistic healthcare.

The combined impacts of changes to the bursary system, demographics of healthcare students, global ill-health have in turn had an onward impact. In particular, subsequent healthcare demands on availability of educators and clinical practice placements have paved the way for much discussion and debate about how best to move forward with education in this new world. This research is focussed on investigating whether VRLE can find a place within healthcare education in a purposeful, impactful and beneficial way for students from a range of healthcare disciplines.

Chapter Two: Literature Review

"There is not a discovery in science, however revolutionary, however sparkling with insight, that does not arise out of what went before." Isaac Newton (Asimov 1964, p.12)

2.1 Introduction

The aim of this literature review was to systematically search for and source information about the use of VR in healthcare education. This chapter will firstly present the literature review strategy which was used to conduct a systematic search for relevant literature demonstrating the contribution to the knowledge base related to use of VR in healthcare education. Following on from that section, the identified literature for this chapter will be critically analysed to identify gaps in the field. These gaps have steered the research for this project to continue to progress this aspect of healthcare education. Finally, a summary of the literature, findings and identified gaps will be provided in order to set the scene for the introduction to and discussion of the research aim, objectives and questions in Chapter Four.

2.2 The literature review strategy

A preliminary scoping review of the literature was conducted during the taught phase of doctoral studies in 2019. This allowed for electronic exploration of various search words and phrases, highlighted the usefulness of available databases, different types of data and tightened up the inclusion / exclusion criteria (Gough et al. 2017). The systematic literature review for this research was conducted initially in February 2020 and then updated with further searches up to the point this thesis was ready for submission to examiners in February 2024. The search criteria process is discussed in detail in section 2.2.2 below.

2.2.1 Databases

Databases which were interrogated ranged from healthcare specific sources of information to technical focused indexes as well as grey databases in order to include opportunities to consult writing not commercially published and reduce risk of publication bias. The information sources which were utilised to facilitate this literature search this are shown in table 1 below.

Healthcare specific	Education specific	Technical databases	Grey databases	Search engine
The British Nursing Index (BNI)	Academic Search Ultimate (ASU)	The Association of Learning Technologists (ALT)	GlobalGREY	Google Scholar
The Cumulative Index to Nursing and Allied Health Literature (CINAHL)	Education Resources Information Centre (ERIC)	Applied Science and Technology Source (EBSCO)	OpenGrey	
The Cochrane library	Multimedia Educational Resource for Learning and Online Teaching (MERLOT)			
Health Professionals	British Educational Research Association (BERA)			
Intermid and Internurse Journals@Ovid				
Medline and PubMED				
PsychARTICLES, BOOKS and INFO				
ScienceDirect Scopus Social Theory & SocINDEX Springerlink				
WHO Reproductive Health Library				

Table 1 - Sources interrogated during literature search.

Relevant textbooks, doctorate theses, conference publications and other high-quality studies were searched for using the GlobalGREY database, and other methods. Medical Subject Heading (MeSH) and free-text keywords were used to facilitate the literature search.

2.2.2 Search criteria and process

A number of Boolean logic searches were undertaken using Bournemouth University (BU) library's search catalogue in order to deliberately maximise results. Truncation was used in order to ensure all variances of words were gathered into the search results. The inclusion criteria are shown in Table 2 below and the exclusion criteria are discussed in section 2.2.4.

Inclusion criteria	Key word combinations, Boolean logic and truncation used
Virtual reality	"virtual reality learning environment" or vrle or "virtual reality learning"
Healthcare	"Virtual Reality" in healthcare and as detailed below
Learning environment	Learning environment N2 student N2 healthcare
Student midwife	Virtual Reality N2 "Student midwi*"
Student nurse	Virtual Reality N2 "Student nurs*"
Student doctor	Virtual Reality N2 "Student doctor*"
Student paramedic	Virtual Reality N2 "Student paramedic*"
Student physiotherapist	Virtual Reality N2 "Student physio*"
Student social worker	Virtual Reality N2 "Student social worker"
Health professional	Virtual Reality N2 "health professional" N2 student
Clinical competence	Clinical competence N2 virtual reality

Table 2 - Inclusion criteria.

2.2.3 Initial stage

This proved remarkably effective and produced an unexpectedly substantial amount of literature as can be seen in the initial stage section of Figure 1 below. Due to the significant number of available literature pieces, articles were selected according to whether they were relevant to the use of immersive VR for healthcare education in HE institutions. In hindsight, the large number of search hits could have been minimised at the outset if the limiter term NOT had been added to the search terms in order to exclude education in primary, secondary and further education.
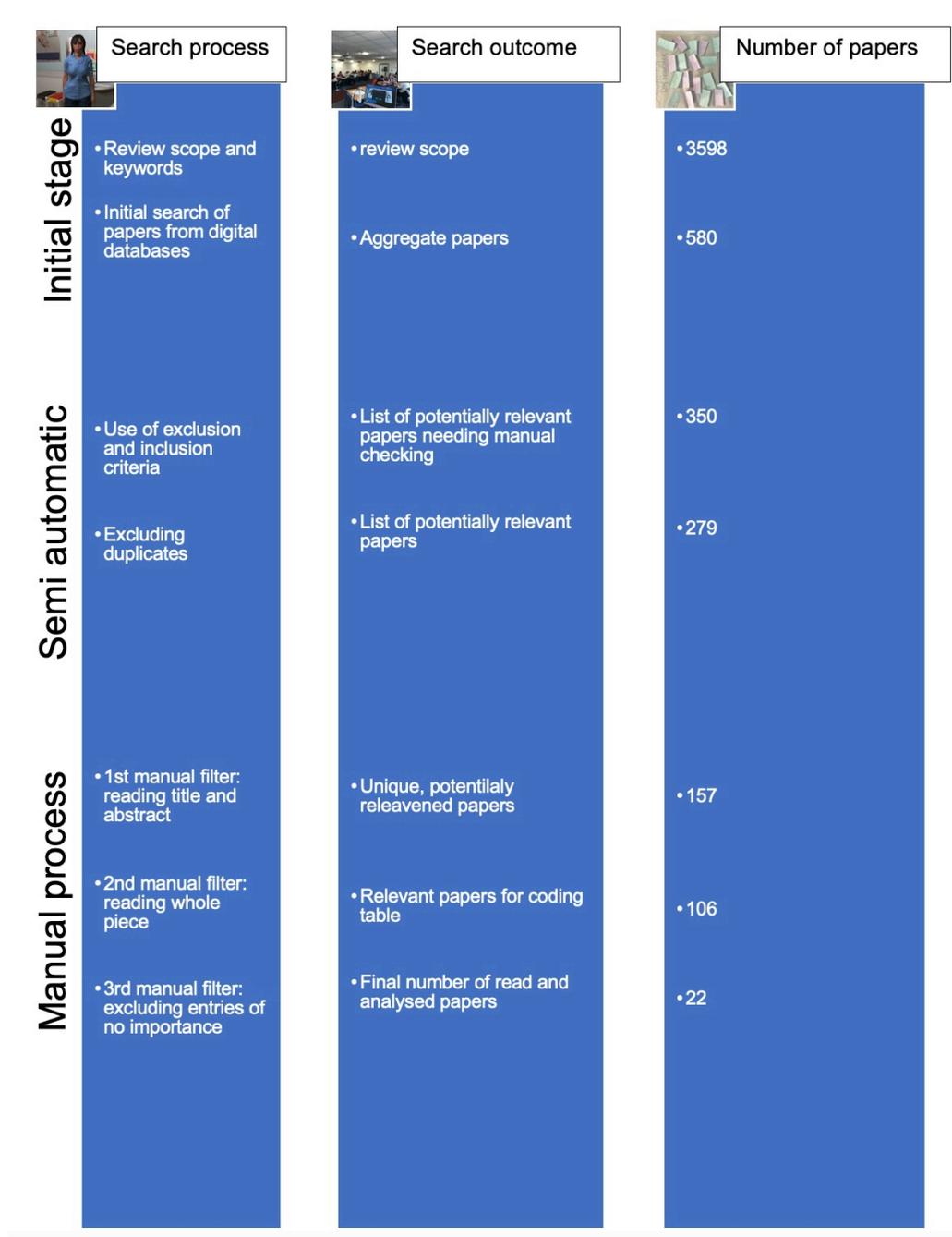
Figure 1 - Literature search process, outcome and total number of papers - adapted from Radianti et al. 2020.

2.2.4 Semi-automatic stage

In the semi-automatic stage demonstrated in Figure 1 above, exclusions were made in order to further reduce the number of potential pieces of literature for review. These exclusion categories and explanation are detailed in Table 3 below.

Exclusion criteria	Explanation
Language	Association with use of languages other than English
Date of publication	Papers published in the years prior to 2010, were included in the initial search as the number of potential papers was not expected to be so high.
Level of education offered by institution	Education which was not for healthcare students in higher education such as primary, secondary or further education (FE)
Simulation training	Education using simulation but not virtual reality (VR) for example high fidelity manikins
Group work	Peer teaching or team-based learning
Focus of learning	VR for foundation learning such as anatomy and physiology rather than clinical skills
Teaching focus	VR used for provision of healthcare to patients
Article focus	Articles about VR design or other technical build aspects related to provision of healthcare education rather than using the VR for healthcare education
No longer available	Literature withdrawn from publication but still available in the library search function
Duplicates	Aggregate and duplicate papers were included in search results despite this being an exclusion ticked during the initial search

Table 3 - Exclusion criteria.

The final step in this stage was to remove remaining duplicates.

2.2.5 Manual stage

This left 279 pieces of literature for consideration which were then further refined during the manual process stage with three readings of the literature as outlined in Figure 1 in section 2.2.3. This process was undertaken systematically by using Cronin et al.'s (2008) process which advises researchers preview, question, read and then summarise (PQRS) literature. This was completed for each of the papers which were found to be suitable for inclusion in this literature review after utilising the PQRS

process. After the three readings which took into consideration the date of paper, type of literature, and detailed analysis of the outcome measures and key findings, the papers were then categorised according to importance and relevance to the discussion. Finally, themes were identified and highlighted for each piece of literature. A further search was undertaken in 2023 to locate any new research publications in light of the Covid-19 pandemic lockdowns influencing an increase in digital technology for education which necessitated the inclusion of a further six articles.

2.3 Themes resulting from search

The suitable papers are from a range of countries and include scoping and systematic reviews, discussion and conference papers, one thesis, quantitative, qualitative and mixed methods research. Whilst this is a varied selection in respect of style, the included literature clearly demonstrates VR initiatives used and the research undertaken to date with using VR for healthcare education Therefore, each is considered to have merit for inclusion in this literature review in order to inform future work in these categories. Appendix 3 shows the categorisation and data extraction detail that led to these papers being accepted for inclusion. It was during this step of the process while making notes on literature read that the themes in Table 4 began to emerge.

Theme	Linking literature	
Use of VR in healthcare education: VR is being used in healthcare education for a variety of purposes.	Bai et al. (2012) Bailey (2012) Duff et al. (2016) Gentry et al. (2019) McGhee et al. (2011) Padhilha et al. (2019)	Sperl-Hillen et al. (2014) Rourke (2020) White (2016) Williams et al. (2018) Ustun et al. (2020)
Student acceptance to use of VR in healthcare education: On balance healthcare students feel positive about use of VR for their education.	Cobbett and Snelgrove-Clarke (2016) Duff et al. (2016) Foronda et al. (2016) Irwin and Coutts (2015)	Ryan et al. (2022) White (2016) William et al. (2016) Ustun et al. (2020)
Contribution of VR to healthcare education: VR has potential to be transformative when looking to modernise traditional healthcare education.	Adhikari et al. 2021 Cobbett and Snelgrove-Clarke (2016) Duff et al. (2016) Gebreheat et al. (2022) Goldsworthy (2022)	Gray et al. (2022 and 2023) Kyaw et al. (2019) Mousavi et al. (2022) Rourke (2020) Samorsan et al. 2019 Wu et al. 2022

Table 4 - Emergent themes linked to literature reviewed.

The literature will be analysed and discussed under these headings as appropriate to their individual content. This narrative synthesis approach was chosen due to its value for grouping pieces of literature together based on the content of the information rather

than limiting inclusion to literature which have a more obvious link between the design and context (Booth et al. 2012).

2.4 Use of virtual reality in healthcare education

With this literature review there are many examples of the way VR is being trialled or used within healthcare education to facilitate learning of clinical skills and clinical reasoning, though it has been argued that not all are as robust as they could be (Duff et al. 2016). Other reviews concurred by concluding that reviewed research lacked depth in various areas, such as research methodology, research participants, data gathered or data synthesis (Schindler et al. 2017; Kyaw et al. 2017). However, it can be argued that these research projects nonetheless did pave the way for further research to be undertaken by others at later dates when technology and other capabilities advanced. Indeed, this did occur more rapidly than expected because of the impact of the Covid-19 pandemic on restricting access to on campus teaching which necessitated a rapid shift to online delivery of the curriculums which had been delivered on campus up to that point (Hodges et al. 2020; Bliss 2021; Power et al. 2021). Healthcare student dissatisfaction and increased sense of isolation were noted in numerous studies which included aspects such as change in ability to socialise (McFadden et al. 2022).

However, it has been argued that relationships can still be developed online and that this can be seen as an increased opportunity to connect with a wider range of fellow students than previously (Perkins et al. 2020). Consideration should be given to the urgency of the implementation of online theoretical learning and that this was the only option available rather than VR being one of a mix of learning tools which would ideally also include traditional on campus learning and which the students could then choose to use for learning instead of having no other option (Luyben et al. 2020). Healthcare students also reported finding it difficult to access online learning whilst caring for their children who needed to also learn online (Renfrew 2021). It can be seen that this could be additionally complicated if the healthcare students then had to immerse in VR as this would further distance them from their children despite the distance being simply in a virtual context. However, at the time of commencing this research it was not known if being able to access virtual learning outside of classroom hours would be perceived as beneficial for healthcare students.

Furthermore, dissatisfaction was reported in relation to first year healthcare students being removed from clinical practice placements (Carolan et al. 2020; Harries et al.

2021; Kuliukas et al. 2021). This was unavoidable due to restrictions imposed by governments and reduced clinical staffing resource availability for support of healthcare students as well as the need to provide extended clinical placements for senior students in order to accelerate their qualifications and join the workforce (NMC 2022). This messaging may have been misinterpreted by nursing and midwifery students who were informed that although they could not undertake clinical placements in their first year of their degree programmes, they could work as healthcare support workers (HEE 2020). Additionally, there were valid concerns about the ongoing impact for students attempting to achieve their proficiencies within the time constraints of their healthcare degree programme after having had less time on clinical placements than their predecessors (Rose 2020). The location of the learning within the VR space was also noted to be inconsistent in terms of venue and importance despite the learning impact implications between various platforms.

2.4.1 Public and private access VR platforms

As noted above, platforms can impact the learning experience. Bai et al. (2012) developed a grant funded prototype of a VRLE on the Second Life (SL) platform using an area available for public use, within which they used the grant to fund creation of a centre where students from various healthcare disciplines could practice profession specific skills before they entered clinical practice in real life. The 33 healthcare students who took part in their study were from occupational therapy, nursing and the allied health discipline of medical assistants. The virtual health centres were designed collaboratively by an interdisciplinary team. Although they do not specify which professions the team was comprised of, it is likely that there were representatives from the students' disciplines. They used mixed methods to research the prototype which was used by the students for one day. The research measured the students' meaningful learning and they found that the vast majority of students enjoyed their learning experience within the 3D space and stated a preference to this compared to traditional paper-based case study. The researchers conclude that 3D virtual simulation is worthwhile for students to engage in learning, practicing skills and evaluating their performance. During the literature search it was noted that continued use of VR in healthcare education after research completion was less evident. The pre-pandemic reasons for this appear to be mostly related to the perceived cost of the initial build of the VR simulations as well as the lack of evidence related to any behaviour change associated with its use (Fertleman et al. 2018).

However, whilst the above results appear promising, it could be argued that the research findings should be interpreted with caution as this was a small study

conducted over a short space of time. No further publications about ongoing use of this prototype were sourced during the literature search and the prototype area was not listed within SL so I was unable to ascertain whether it is still in use. Therefore, this research study does not allow for measurement of students' deeper learner and long-term satisfaction with this type of education compared to a traditional equivalent. Furthermore, although this study mentions that they have proved that this type of education is financially feasible, they do not mention the cost of building and maintaining this learning resource. Additionally, there is no mention as to whether this protype is now situated in a private area within SL. Locating the learning within a private space would be beneficial for safeguarding students from other non-student platform users.

Safeguarding students whilst they are engaged in the learning experience is a key consideration when using VWs for educational purposes (McKenna and Jones 2012; Razeeth et al. 2019). Bailey (2012) developed a virtual maternity ward as an educational tool on the University of Nottingham's Island on the online virtual world SL (Linden 2018) to support student midwives with learning aspects of communication related to the three stages of labour. This virtual labour ward was open to all users of SL meaning that anonymous observers and other SL users could view the students' practice. For those wishing to fine tune their existing skills, the benefits of this learning opportunity are clear. Bailey (2012) claimed that other SL users observing the students at practice were also able to learn from the scenarios. However, it could be argued that being observed by unknown SL users might make students reluctant to practice their skills in a virtual world (WV) due to concerns that their mistakes could be judged by the untrained observers.

Although VWs can expose students to unexpected attention from onlookers, within a VRLE the students are in a place where access is controlled by an enrolment gatekeeper and therefore in direct contrast to more open access environment found within VWs. This safeguards the student's learning experience by restricting exposure of the learner to that of like-minded users. Petrakou (2010) conducted research with communication students who met for classes in SL and their findings suggest that VW distractions may in fact be beneficial for students. They argue that this is because of the myriad of experiences which exist in VW outside of the virtual campus which provide opportunity for social interaction which they suggest facilitates and contributes to the success of collaborative work. However, earlier research by Warburton (2009) warned that effective collaboration needs to be carefully constructed rather than expecting it to occur in the same way it would outside of the VW because of the

difference in communicating and documenting the collaboration. Another aspect which requires consideration when incorporating curriculum content in a VW is that there are readily available distractions present. These range from alluring places to explore within VW such as SL, interesting and unusual avatars in public spaces, the ability to fly and teleport, as well as myriad tweaks that can be done to the individual's avatar at any time to name but a few. Distractions are just one of the aspects which can impact the effectiveness of learning within VR which undoubtedly has led to effectiveness being the focus of a number of the literature cited above.

2.4.2 Effectiveness of learning in VR

If distractions are removed this facilitates research focussed on VR effectiveness. Duff et al. (2016) explored the evidence base for VR technology used for simulation and concluded that virtual simulation was comparable in effectiveness to that of traditional simulation, particularly for those students in the earlier years of their educational programme, but that more in depth investigation was needed to confirm effectiveness and impact. Within this evidence base they found that VR was being used to deliver education related to clinical decision making and the associated reasoning, diagnostic competency, increasing clinical confidence, responses to clinical major incidents and emergencies. The RPs included healthcare students from various disciplines (medicine, nursing, forensic science and veterinary medicine) and they concluded that VR had much to contribute to healthcare education. In particular the example of use of VR to support students to learn skills for heart murmurs and breath sounds which could be replicated in VR and could not be done with patient actors was cited as a contribution to healthcare education.

Sperl-Hillen et al. (2014) conducted a cluster-randomised trial (CRT) to test the efficacy of VR simulation for diabetes care on 341 junior doctors in America who were studying on 19 different learning programmes and a variety of types of medical specialities. The average number of hours spent on the VR was 5.2, this was undertaken once a month for 6 months and there were 18 different scenarios available for learning from. Sperl-Hillen et al. (2014) concluded that the beneficial learning acquired through VR simulation was statistically significant and that VR simulation of clinical care would be of value to students of other healthcare disciplines from nursing to pharmacists. Padilha et al. (2019) undertook a Random Controlled Trial (RCT) with 56 Portuguese nursing students in order to determine knowledge gains related to clinical decision making for deteriorating respiratory patients in primary and secondary clinical care venues. They assessed knowledge and skills pre-action, immediately post-action and two months afterwards and concluded that VR does contribute to long term knowledge

gains. Interestingly the research participants only used the VR for 20 minutes each so it can be argued that the impact of the VR simulation on learning gains is considerable if the retention is still measurable two months after the action.

What is not clear is whether this can be a true test of the learning gained through VR. Unless the participants had been on a complete learning break during the two months between the two post-action measurements there would have been learning opportunities in addition to the VR simulation action. A review was done by Gebreheat et al. (2022) who concluded that VR could offer valuable learning and practice of skills for urgent and emergency care, but highlighted that the cost-effectiveness of this compared to other types of simulation driven learning had not been evaluated. Of additional importance is consideration of whether the complexity of the learning contributes in a positive or negative way.

2.4.3 Complexities of virtual reality learning

Research into learning complexity within VR has been undertaken. Observational research undertaken by White (2016) noted that user engagement is more complex than just the placement of objects in relative proximity to the user within the scenario and also involved elements such as user experience with gaming tools and other aspects of VR use. Foronda et al. (2016) trailed virtual simulation with 120 nursing students who were given time to complete a tutorial prior to use and they also worked through the trial in pairs rather than individually as in Cobbett and Snelgrove-Clarke's (2016) study. Although Foronda et al.'s (2016) research findings do not state whether there were technical issues experienced by the students' they did report that students experienced some frustrations with some of the features such as having to watch handwashing and that it was difficult to perform some tasks simultaneously as they would do in real clinical practice.   Overall, the students reported that they found this easy to use, a positive experience and recommended it for future use.

William et al.'s (2016) study into use of VR for clinical skills related to blood taking showed that students found it difficult to multitask within the VR simulation, though 65.5% of participants felt that the simulation was beneficial in helping them to perform this skill on actual patients and 94.7% felt that VR simulation was beneficial for remembering the correct sequence of clinical tasks for this procedure. More recent research with HE chemistry students (Winkleman et al. 2020) supports this finding by White (2016). Winkleman et al.'s (2020) research showed that education in a carefully constructed study space within a VW which replicated the on-campus study space,

reduced distraction and achieved similar educational outcomes to the on-campus chemistry lab.

Overall, it can be seen that the learner must have some understanding of how to use VR and the VW as this will reduce the complexity and facilitate focus on the required learning. Additionally, they should also be in a space constructed for and dedicated to learning in order to focus on the educational experience and reduce risk of distractions.

2.4.4 Skills

Clinical skills for healthcare can be divided in to two broad categories; hard skills and soft skills (Sherine et al. 2021; Lamri and Lubart 2023). The literature is more heavily weighted towards developing ways in which to practice hard skills in VR. Table 5 below gives an example of the difference between hard and soft skills.

Hard skills	Soft skills
Equipment dependant clinical skills	Perception and communication dependant skills
Blood test / injections / other procedures	Recognising and acknowledging that although it is unspoken, the client is frightened to have the blood test / injection / other procedure and then finding ways to support them to be able to undergo the test.

Table 5 - Author's own example of the difference between hard and soft skills.

McGhee et al. (2011) explored the concept of using VR to teach Scottish nursing and midwifery students' clinical skills and in particular considered using the application called Skills2Learn who develop digital healthcare education. They considered the VR available at the time which was a hard skills based antenatal anatomy and physiology module to support development of abdominal palpation skills as well as a nursing ward to support learning basic nursing skills. McGhee et al. (2011) concluded that their VR simulations were lacking in supporting students to develop soft skills such as those that related to the humanisation of healthcare which, as discussed in Chapter One (section 1.4.2), is a significant aspect required for robust healthcare education. White (2016) undertook observational research investigating the decision-making complexities experienced by healthcare professionals when in situations where they needed to use soft skills to challenge clinical colleagues and in particular ones which they perceived to be senior to themselves.

Being able to challenge is a soft skill necessary to advocate for healthcare clients in order to ensure their episode of healthcare is a beneficial experience as well as having the benefit of increasing job satisfaction (Begley 2009). A total of 58 participants from various roles within healthcare were involved in White's (2016) research which included use of a VR simulator and comic book prototypes. A post action questionnaire to explore long term learning gains was included in the data collection methods and which just under half (n=22) of the participants completed. Recommendations stemming from the research data analysis included the need to be mindful of keeping the VR simulations simple in relation to usability so as to make the learning inclusive, tutorials or practice time before the action is assessed, use of realistic scenarios and visual fidelity within the simulation.

Rourke (2020) conducted a systematic literature review to explore ways in which VR simulation was being used in nursing education. Included papers were from the USA, Kuwait and Turkey with the research for these conducted between 2003 and 2018. The review found that overall, the skills being taught were ones which required dexterity and fell into two main categories of hard skills practice; venepuncture for blood taking and catheterisation for urine. It is curious that these skills appear the most popular for nursing students when the nursing role is significantly varied and there are many other clinical skills which could be developed into VR simulations. Furthermore, it might be possible to adapt existing VR simulations such as those used for medical students in Sperl-Hillien et al.'s (2014) research to support other types of healthcare education such as that for student nurses. It is unfortunate that the research undertaken by Padihila et al. (2019) falls outside of Rourke's (2020) inclusion criteria because it may have had an interesting influence on the findings. This is due to Padihila et al.'s (2019) research investigating a different aspect of clinical skills for nursing students by taking a more holistic view of the impact of application of knowledge in affecting the patient's wellbeing. It can be summarised that there is a limited amount of research on use of VR for learning and practice of soft skills and the focus up to this point has been on the use of VR for acquisition of or practice of hard skills.

2.5 Student acceptance of virtual reality use in healthcare education

In Duff et al.'s (2016) literature review there was mention of students stating that they appreciated the fact that VR allowed them to have a safe place to practice before delivering care in real life, but it is not clear whether this meant safe for themselves or their future patients. This is discussed further in section 3.6 which focusses on the contribution of VR to healthcare education. Research into using VR simulation and comic book technologies to support clinical decision making to challenge colleagues or

to resolve conflicts, was accepted by students (White 2016). Although the RPs offered suggestions for improving the learning experience, they also showed appreciation for the VR simulation compared to the comic book version of the training. Furthermore, they identified areas where they felt VR simulation would be beneficial for future clinical learning which it could be argued suggests they not only accepted VR for their healthcare education but they also wished to have additional opportunities to learn using VR.

Ustun et al. (2020) undertook a quantitative study to explore the acceptance of research participants' to learning using VR technology in medical studies and concluded that there was high acceptance and wiliness to use VR applications. The research participants recorded that the VR helped them do coursework faster, improved their performance, motivation and productivity. The researchers found that primarily VR was used for surgery training and rehearsal of procedures ranging from the intricacies of neurosurgery through to insertion of epidurals. They decided that there were limitations related to generalisation as the study only explored learning related to anatomy. However, they did suggest that one of the benefits of VR simulation was the breadth and scope of the scenarios that can be generated and that these require minimal resources compared to real life clinical situations. They did not discuss the cost of creating VR simulations or the availability of funding for development of these. They concluded that further investigation was required not only in other topics but also in other healthcare disciplines in order to form conclusions about the acceptance and use on a wider scale within healthcare education. Research has shown that students accept the option of VR for learning which has been offered and there is a need to expand the subjects taught in VR to include a wider variety of skills including soft skills.

2.5.1 Positive and negative contributions to educational VR acceptance

Cobbett and Snelgrove-Clarke (2016) conducted a randomised controlled trial (RCT) to compare the effectiveness of VR vs F2F clinical simulation for two different clinical scenarios in relation to knowledge, confidence and anxiety for 56 participant nursing students. Although they found no difference in the learning acquired though either method, in nearly half of the participants there was a higher student stated preference for the F2F learning due to the technological issues experienced. The researchers did not state how long the students had to use the VR scenarios and it is worth considering whether the technological issues would have been worked through over prolonged use and familiarity with the VR equipment / platform. The researchers did acknowledge

however, that this frustration with the technological issues may have been lessened if the students had access to an orientation activity prior to commencing the study.

A systematic literature review was conducted to investigate use of SL for the education of nursing students who came from several interdisciplinary specialist areas from mental health to emergency nursing (Irwin and Coutts 2015). One of the studies in the review was undertaken with students who were in different countries and expected to function clinically within the same scenario simultaneously in SL. They also discovered a large number of small studies with fewer than 50 participants and a few larger studies where the participants numbered 100 or more. Overall, they concluded there is evidence that student engagement is high but recommended that additional larger studies were undertaken to provide more concrete evidence of this.

Several studies cited in the previous section and in this section discussed the benefits of using VR in healthcare education. The common benefits of improved engagement and enjoyment of the learning experience underlines student acceptance of VR use as part of their education (Bai et al. 2012; Sperl-Hillen 2014; Foronda et al. 2016; White 2016; Williams et al. 2016; Ustun et al. 2020). Also considered is the lack of and need for ongoing use of the researched innovations in order to provide more knowledge about the long-term impact of VR use in education (Kyaw et al. 2017). In the next section the specific areas in which VR is known to contribute to healthcare education will be discussed.

2.6 Contribution of virtual reality to healthcare education

2.6.1 Distance learning and skills practice

Literature reviews have identified a variety of learning gains when VR is used for healthcare education, particularly in the area of improving diagnostic reasoning and clinical decision making (Duff et al. 2016; Hara et al. 2016; Gentry et al. 2019). More recent research includes a small research project was done to explore impact of 3D learning on 38 student midwives' skills for the third stage of labour with 20 being in the control group and 18 being in the action group. This study concluded that the students felt strongly that this was a useful learning resource despite not having measurable knowledge gains over traditional learning methods (Gray et al. 2022).

However, a review of learning outcomes by Ryan et al. (2022) of 2,722 healthcare students concluded that not only was student satisfaction increased when learning with VR but the learning gain was no different to that from traditional teaching methods. Unfortunately, all but one of the above research reviews focused on a specific

healthcare discipline rather than mixed disciplines learning from the same VR scenario and therefore the learning gains are not generalisable. This gap will be investigated in this research by exploring whether VRLE could be designed in a way that would be useful to healthcare students in general which would maximise its potential as a learning resource.

Researchers also stated that there were benefits to be had for those students who did not live close to their chosen educational institution (Duff et al. 2016; Fonsesca et al. 2016; Goldsworthy 2022; Gray et al. 2023). These benefits were identified for the learner as well as onward positive impact for patient care as they remained close to the local healthcare facilities throughout their time spent studying. The challenge is whether this stated benefit by Duff et al. (2016) would be available to enough distance learners. This is because there is a need for a reliable broadband connection for the effective use of VR. This needs to be explored in more detail before definite conclusions can be reached.

In Kyaw et al.'s (2019) systematic literature review on use of VR for health education related to clinical and surgical skills, they included a total of 31 studies (2407 participants) and found that that there was a paucity of research conducted in low to middle income countries and stated that this is where innovative educational strategies are particularly required. It requires further investigation to unpick why there should be such a difference between ability to access web-based e-simulation and VR simulation. Meeting the diverse learning needs of large cohorts of the healthcare students of today on a global scale requires innovative and pedagogically informed revolutionary solutions to the above problems. Additionally, they stated that the majority of actions they included in their review were not implemented as part of curriculums, and it can be seen that this will limit the longevity of exploration into impact on healthcare education.

Cobbett and Snelgrove-Clarke (2016) concluded that there is value in using VR for healthcare education which may outweigh the possibly easily resolved technological frustrations which were reported by the students. They state that this is due to the comparatively reduced cost when measured against the price of F2F teaching with high fidelity mannikins which are expensive to purchase and also require the support of a trained facilitator and a venue to house the mannikin and as well as room to use for teaching purposes. Interestingly one of the conclusions was that VR can be of benefit in these times of reduced clinical placements which is similar to Duff et al.'s (2016) suggestion that VR can be of benefit to students who do not live close to areas of study.

Therefore, VR could be used to create spaces for healthcare students to undertake simulated clinical practice for a variety of reasons including distance from learning institution, improvements in educational offers for students in low to middle income countries and providing clinical spaces for tasks such as learning timings for emergency situations and making up missed hours (Foronda et al. 2016; Perkins et al. 2020; Goldsworthy et al. 2022; NMC 2023).

2.6.2 Creation of space to make up missed clinical hours

Although students who took part in the study by Foronda et al. (2016) enjoyed using VR, the researchers were hesitant to recommend VR for partial or more replacement of traditional healthcare education, until further evaluation was undertaken to assess whether there was value in this. They stated that the benefits of VR noted during their study were the provision of direct feedback, the detail of the content, the reported ease of use and that overall they felt that VR has potential for numerous applications within healthcare pedagogy. The researchers stated that further research is required in order to identify which applications would be of most benefit in comparison to learning with more traditional mannikin-based simulation. They ended by suggesting that there may be value in considering use of VR to facilitate replacement of missed clinical experience hours.

Sperl-Hillen et al.'s (2014) research was determined to be important due to the reduction in clinical work hours which was felt to risk these postgraduate students in deskilling in diabetic deterioration management and other areas of clinical care. Additionally, this was the only research in this literature review that was able to facilitate autonomous learning by allowing users to follow individual trajectories based on decisions made throughout the simulation for each virtual patient case study. Irwin and Coutts (2015) also raised the issue of the debate around evidence showing that VR learning experiences being authentic and clinically valuable and yet there is reluctance to allow VR clinical practice hours to replace the equal number in real time. It can be suggested that this may be in part due to the awareness that healthcare is more than the application of a set of clinical steps taken to resolve a health complaint or crisis which are also known as the 'hard' skills.

Equally important in the provision of healthcare are the use of 'soft skills' to humanise our clinical interactions. Communication, compassion, confidence to advocate for the healthcare user, the ability to contextualise information, to use it appropriately and an awareness of the healthcare service user as an individual despite the clinical condition

they may have are all ways of utilising soft skills when providing clinical care. Humanised care can be summarised as keeping the person experiencing the healthcare episode at the centre of all we do as healthcare professionals (Phelan et al. 2020).

In fact, the humanisation of healthcare is of significance to the care receiver and care giver alike (Todres 2007 and 2009, Fry 2007, 2009 and 2017). Therefore, this aspect requires further investigation in order to determine whether VR can support acquisition or enhancement of this skill, before an argument can be made for the validity of a like-for-like exchange of clinical practice hours. However, there are currently limited detailed specifications for the use of VR in healthcare education related to soft skills. It can be seen that this is required to clarify and streamline the ways in which VR can be used most effaciously as part of modern healthcare pedagogy in its entirety. This is an area which it is expected this research will be able to contribute.

2.6.3 Knowledge gains

Knowledge retention longevity gains when using VR simulation has been noted in several studies involving nursing and medical students. William et al. (2016) explored the value of using VR for phlebotomy practice as a quasi-experimental quantitative study on 62 nursing students at two different schools in Kuwait. The participants were also asked to comment on whether the VR had helped them perform the procedure on real life patients. The researchers were reluctant to draw firm conclusions on the value of VR simulation training compared to the real-life comparator due to the perceived small sample size in this study. Padilha et al.'s (2019) RCT demonstrated that virtual simulation offered more practice opportunities with similar results to real life clinical practice experiences. They stated that the virtual simulation group had significant learning improvements, retention and that the 42 nursing research participants reported learning related satisfaction.

Samosorn et al. (2020) conducted a small pilot study with 21 American students and 10 faculty members to explore learning how to intubate patients in virtual reality. They concluded that particularly when full immersion can be offered, VR can be used successfully as an action to significantly boost short term knowledge gains in nursing education. Goldsworthy et al. (2022) undertook a study of nursing students from five universities in four countries which explored the impact of VR on their ability to function clinically in relation to deteriorating patients. This study had a total of 88 research participants divided between control and action groups and the study concluded that VR offered improvements in cognition and confidence.

The value of short-term surface learning knowledge gains in relation to the overall purpose of healthcare education is questionable when compared to deeper long-term learning, though ways to reliably measure this remain elusive (Cadorin et al. 2016). However, if VR was offered as a bridging action between theory and clinical practice then the short-term knowledge gains expressed in Samosorn et al.'s (2020) study can be seen to have intrinsic value. Furthermore, if Soamosorn et al. (2020) had conducted a post-action follow up assessment of skills which had not since been practised in the clinical environment, then they may have been able to draw conclusions that these knowledge gains from VR simulation practice were not short term.

Indeed, the systematic literature review done by Irwin and Coutts (2015) found that despite the research being in what they felt were early stages, there was evidence of longer-term learning gains in the virtual environment as the learning was being transferred to real life clinical settings. Therefore, they were able to conclude that the use of VR in healthcare education was a positive addition. Kyaw et al.'s (2017) systematic literature review found that of the 31 studies they reviewed there was mostly reporting of post action data which made it impossible for them to understand the depth of change resulting from the use of VR as an educational strategy. However, based on this they concluded that there are indications that higher interactivity VR can contribute to knowledge gains and improving clinical skills. Of note, there is a commonality with all of these in that they cautioned that further studies were required, along with recommendations that the long-term and deeper knowledge gains were assessed further.

There has also been research conducted on qualified healthcare professionals which produced similar results. Sperl-Hillien (2014) undertook a RCT which involved 341 qualified physicians to explore the usefulness of diabetes management training using virtual simulation and concluded that this improved clinical skills, management and confidence. Interestingly Cooper et al. (2017) surveyed learning gains comparatively between 5,511 student and qualified nurses from 20 countries and found that there were significant increases in knowledge with no difference in the gains from undergraduate or postgraduate learners when practicing clinical skills on simulated patients. However, Rourke (2020) concluded after examining nine mixed method studies to compare VR and non-virtual simulation of skills that the VR learning gave rise to outcomes which were superior to those gained from traditional simulated practice, though again concerns were raised over the cost of investment in VR.

It is worth noting that with VR offering students the opportunity to learn from the simulation numerous times, their clinical competency and confidence should increase proportionally as a direct result. Therefore, it can be surmised that VR can offer value for money. It could also be argued that this would comparatively reduce the overall long-term cost of VR teaching and learning because the VR learning simulation only needs to be built once and the teaching time is reduced to a feedback session once the theory and practice has occurred within the virtual space.

2.6.4 Safe fails

Bailey (2012) stated that use of VR allows healthcare students to make mistakes without causing harm to actual patients. For the purpose of this literature review and research project this will be referred to as safe fails. It is unclear whether the VR included in Duff et al.'s (2016) research was synchronous or asynchronous, public or private. Therefore, it is not known whether this also related to safeguarding of students as highlighted as a concern above in discussion of Bai et al.'s (2012) research, or whether this was in reference to safe fails. Williams et al. (2018) suggest that clinical experiences using VR to practice skills offers healthcare students an opportunity to learn through safe fails and to undertake these as often as they wish until they have acquired the necessary skill to an acceptable standard. Study data has demonstrated that VR can make a positive impact on teaching safe clinical practice and associated quality of subsequent healthcare (Padilha et al. 2019; Mousavi et al 2022). William et al. (2016) also felt that VR simulation procedures has much to offer in respect of bridging the theory / practice gap which in turn may increase the safety of patients.

VRLE can support students to conduct patient examinations with suitable responses by the simulated patient should the student make errors. However, it has been argued that VR cannot offer the richness of experience that comes with real life clinical placements where students are able to make clinical judgements based on the patient's tone of voice, nonverbal communication, odour and other methods of assessing patient wellbeing (Chen et al. 2017). Reassuringly, Williams et al. (2018) feel these issues above are not insurmountable. As a result of their research into using VR to teach neonatal resuscitation to healthcare students at University of Newcastle, they feel VR can offer a suitable place to practice clinical skills. Utsun et al.'s (2020) RPs stated that VR clinical space gave them a safe and individualised place to improve their skills, and that these learning spaces reduced anxiety and prevented the boredom experienced when learning in class. This was further supported by research which concluded that VR increased student confidence in clinical skills and decreased their anxiety whilst practicing these skills though they noted that the small sample size (n=19) was a

limitation (Adhikari et al. 2021). A RCT with 105 RPs concluded that VR for clinical practice offers numerous benefits comparable to traditional simulation learning using manikins including increases in clinical knowledge and confidence (Wu et al. 2022). It can be seen that using virtual clinical environments to practice the more practical skills such as the physical performance of clinical procedures offers healthcare students an opportunity to learn through safe fails.

Although individualised learning is mentioned as a benefit by the research participants in Wu et al.'s (2022) study, it is not clear from the quantitative data if the VR simulated clinical space facilitated autonomous learning as a result of the stated benefits or whether the research participants followed the set path through the VR clinical simulation. This is an area which would benefit from further investigation because healthcare professionals are expected to be lifelong learners and to do this, they must have the wherewithal to undertake this learning autonomously to in part meet the professions expectations for revalidation (NMC 2023g, RCOG 2023, UKPHR 2023). Therefore, it is an important factor to consider for the healthcare education of undergraduate students in order to give them the tools to develop cultural habits to be early career professionals from the outset.

As part of Kyaw et al.'s (2019) literature review they explored the effectiveness of incorporating VR into health education. They recommended that further research should be undertaken to compare effectiveness of highly interactive VR with VR which had lower interactivity. Matthews (2019) concurs and stated that even though we may not behave in VR exactly as we do in real life, virtual behaviour is still important. In healthcare professions an individual is expected to practice within strict professional boundaries that encompass everything from professional practice to professional identity which adds to the complexity of supporting individuals to learn how to *become* a healthcare professional as opposed to simply learning what is the *expected* behavior of a healthcare professional (Lawson 2016, NMC 2023b). White's (2016) research showed that learners preferred the VR simulator but wanted the scenarios to be as realistic as possible.

Upon reflection of the importance of professional cultural identity and role expectations, this can be understood to be linked to more than just wanting to have realistic game play because realistic healthcare scenarios will facilitate the learner engagement with the scenario and the deeper learning. The learners also were accepting of medium fidelity VR simulation which is an important aspect in considering whether VR can be accessible to all learners.

2.7 Identified gaps from the literature

As discussed, use of VRL in health professional training programmes offers benefits in terms of addressing the increasing student numbers and decreasing availability of clinical placements (Cobbett and Snelgrove-Clarke 2016, Duff et al. 2016, Williams et al. 2018, Fealy et al. 2019). This was put to the test during the Covid-19 pandemic when universities were unexpectedly forced into delivering all possible healthcare educational content online. Use of the VR simulations for clinical practice in virtual family homes, virtual hospital and virtual community clinics would have allowed first year healthcare students to have clinical experiences and skills practice sessions that they would otherwise not have been able to gain due to not being allowed to go into clinical practice during the early phases of the Covid-19 lockdowns (Carolan et al. 2020; HEE 2020; Luyben et al. 2020; Harries et al. 2021; McFadden 2022).

Whilst it is clear that more work needs to be done to make the use of VR in healthcare education accepted as part of the cultural norm (Renfrew 2021), it can be seen that using VR to engage healthcare students can encourage them to recognise their learning as a stimulating and enjoyable aspect of their education (Fealy et al. 2019; Gebreheat et al. 2022). This will lead to benefits for both the healthcare student, whether they are learning individually, in groups or as part of a multidisciplinary team, and for their patients who will subsequently benefit from the improved healthcare skills (Bai et al. 2012, Sperl-Hillen et al. 2014, Cobbett and Snelgrove-Clarke 2016, William 2016, Somosorn et al. 2019, Utsun et al. 2020).

2.7.1 Humanisation of healthcare

Rourke (2020) expressed concern that VR only allowed students to practice a limited number of technical skills and questioned whether VR could be of use in supporting students to learn non-technical skills. Other researchers (McGhee 2011, White 2016, Rourke 2020, Ustun 2020) have also highlighted that the question of whether effective use of soft or non-technical skills can be taught using VR simulation is an area which remains unknown. It was suggested in the early 2000s that VR could help improve the "relationship" between doctor and patient through lifelike practice in VR simulators (Reznek et al. 2002, p.85). Therefore, the possibilities of using VRLE in relation to practice humanisation of healthcare is an area which my research will explore.

2.7.2 Clinical intuition

Studies have shown that despite healthcare students possessing sufficient knowledge to qualify, they can still demonstrate a lack of efficiency and skill in the clinical practice (Feasy et al. 2019; Williams 2018; Jahanbin et al. 2012). Thus, it can be argued there

is more to becoming an effective practitioner than simply passing structured assessments of practical and academic competence and consideration also needs to be made in relation to whether there is adequate opportunity for healthcare students to experience uncommon or unfamiliar clinical events. Healthcare students' skillset will be enhanced by the ability to harness clinical intuition, prior to qualification in order to anticipate, plan, offer, and confidently deliver holistic care in partnership with service users and multidisciplinary colleagues (Barnfather 2013; Melin-Johansson et al. 2017; Angelo and Campbell 2019). A mixed studies review highlighted the importance of clinical intuition as part of healthcare practice and indicated that there is a need for further research into ways to develop education related to clinical intuition education (Pearson 2013; Melin-Johansson et al. 2017).

It can be seen that practice opportunities are also then equally important in order to ensure application of theory to practice and deepen learning (Diekmann et al. 2007). Research from the late 20th century and more recently, indicates that VR simulation might provide an additional dimension of clinical practice opportunity beyond that of scenarios or simulation mannikins (Kling-Petersen et al. 1997; Shao et al. 2020). Although research was focussed on clinical skills such as airway management, operative and emergency skills, the importance of clinical intuition as a clinical skill in other areas of healthcare provision is also recognised (Cunha et al. 2022). As highlighted in this literature review, there is scant research related to healthcare student experience of learning how to use their clinical intuition within VRLE. This research will explore the possibility of developing and practicing clinical intuition skills within VR.

2.7.3 Learning autonomy

As discussed in Padihila (2019) and Samosorn et al.'s (2019) research, questions remain as to whether there is value in students having VR space to undertake practice of skills as often as they wish until they have acquired the necessary skill to an acceptable standard. Foronda et al.'s (2016) earlier research also voiced caution about this aspect as although their research participants had said they would recommend it for further use, the researchers questioned if this might change if they had been using it as individuals rather than in pairs. It is an interesting question about whether this open / longer access would facilitate autonomous learning and whether this would be an opportunity enough student would make use of. The 2019 Topol Review identified VR as one of the top ten digital technologies expected to impact 80% of the NHS workforce increasing proportionally during the next 20 years. This supports the premise that VRLE could have a place situated within healthcare education. It has been suggested

that use of VR in health education could compensate for lack of available clinical placement experience by acting as a space to practice clinical skills and that VRLE could be effective in increasing student confidence and competence in individual disciplines (Bailey 2012; Corbett et al. 2016; Peres 2016; Williams et al. 2018 and Fealy et al. 2019). More research needs to be done to investigate the impact of VR simulation to explore whether learning within and access to VR simulations supports development of autonomy.

2.7.4 Transferability of learning

Duff et al. (2016) argued that VR simulation could have a positive correlation with patient care and satisfaction because they would remain in the patient's locality rather than going away to learn. There is a gap here to be explored in that it may be that VR simulation has an associated impact on patient care (Bai et al 2012; Irwin and Coutts 2015; Padilha et el. 2019). Though this would be difficult to measure accurately without involving patients in research which would be best undertaken as an individual and singular research project. However, whether healthcare students perceived that their use of VR simulation has improved the patient care they are able to skilfully offer could be explored in conjunction with other research questions and one which will be investigated as part of this research project. Therefore, the potential for transferability of clinical skills learning gains from VR simulation will be explored.

2.7.5 Generalisability

There have only been a few studies which had multi-disciplinary participants (Bai et al 2012; White 2016) and more research needs to be done to identify the cost-effective affordances of creation of VR simulations (Duff et al. 2016; Williams et al. 2018; Kyaw et al. 2019). If VR simulations can be useful for learning by more than one healthcare profession, institution or country then this could contribute to reducing the cost of creating VR simulations. Arguably this cost reduction could allow for creation of more "realistic avatars" as this was highlighted as a possible limitation in research with GPs (Drewett et al. 2019). This is discussed in Chapter Three and Chapter Five when considering the creation, cost and use of virtual reality learning environments created for this research. There remains a research gap on whether VRLE designed for use by multiple healthcare disciplines can have a generalisable and transferrable impact on their clinical confidence in practice and perception of onward patient safety. It is hoped that addressing this gap will allow this research to contribute to the pool of knowledge related to whether VR simulations are generalisable amongst various healthcare disciplines.

2.7.6 Degree of fidelity

Although Samosorn et al. (2019) and Downer et al. (2019) found that in VR can be used successfully as an action to increase short term knowledge gains in nursing education, knowledge gaps remain over whether VR simulation offers effective learning when experienced without full immersion, for example when viewed without use of a headset. This is important to clarify with a larger study as some people can develop cyber motion sickness and complain of feelings of disorientation, nausea or develop a headache when fully immersed in VR simulation through headsets, and therefore VR simulation would not be a viable option for them meaning their educational offer might be inequitable in comparison to other students. Minimal to no cybersickness was noted in Samosorn et al.'s (2019) and Downer et al.'s (2109) research but an earlier scoping literature review (Williams et al. 2018) highlighted this as an adverse aspect of using VR simulation.

White's (2016) research on a smaller cohort showed that users positively rated their experience with medium fidelity VR which does not require the user to be fully immersed. However, it is not clear whether using VR simulations without being fully immersed would prevent feelings of cyber sickness for all users or whether medium fidelity use has a measurable comparable learning impact. This needs to be researched to unpick the affordances of this method of learning for the diverse needs of healthcare students. However, this was not included for this research because of the limited availability of head mounted device (HMD) which allow full immersion in the VRLE.

2.7.7 Curriculum situatedness

Kyaw et al. (2017) highlighted concern over actions not being part of curriculums and research needs to be done to demonstrate whether possible for VRLE to be embedded into healthcare curriculums in a way that is transferable and sustainable. This has been addressed within the midwifery curriculum at the institution this doctorate is being studied at with VRLE for various clinical skills. This is now on a trial implementation for two years in order to support research into affordances of VR for formal embedding of midwifery healthcare education. This trial implementation will facilitate the exploration of the points in the paragraph above including collaboration with students as well as requesting detailed feedback in order to improve the VRLE experience for them. This process is highlighted as a key aspect of developing quality and sustainable innovations in healthcare education which place students at the centre of the innovation (Munoz et al. 2017; Regmi and Jones 2020; Renfrew et al. 2021).

Along with student acceptance of the innovation, the acceptance of faculty to VR simulations is an important consideration for future research in order to determine the likelihood of widespread and sustainable use by healthcare educators within faculties (Ustun et al. 2020). Work needs to be done to find the perfect marriage between VR and traditional simulation and it may be that will necessitate a blending of the current available methods. For example, a mix of synchronous and asynchronous VR simulations so that the students can then practice their skills either individually or in groups without lecturer involvement. The educator's involvement could take place either prior to the VR simulations or as a follow up to consolidate / test their learning experiences when traditional hand on simulations could be utilised if necessary.

2.8 Summary of identified research gaps

There appeared to be a scarcity of research related to:

1. Whether use of VR simulation has a measurable impact on non-technical clinical skills such as the softer skills required to provide holistic care
2. If VR can positively contribute to intuitive practice skills such as clinical intuition
3. Potential of a VR scenario to be generalisable so the same scenario can be used for students from different healthcare disciplines to support their learning autonomy
4. Whether VR simulations are perceived to offer transferable learning impacts and what might limit this
5. Whether VR simulations are suitable for use by multiple healthcare disciplines to practice clinical skills as a group for example with providing urgent or emergency care and if this can support asynchronous and synchronous use.
6. Measuring the impact of full immersion versus partial immersion on the transferability of learning
7. The situatedness within curriculums and resultant acceptance

Ensuring healthcare is humanised is a significant aspect of our good healthcare provision. In addition to this, effective clinical intuition can often make the difference between giving partial care; that which treats only what we can see and measure, and holistic care; which is giving the care that is needed but may not always be measurable with any standard healthcare tools. Seeking to practice holistically thereby ensures that that which we at first may only intuit, can be watched for or explored for in order to be prepared to address and include in the ongoing care. Experience is essential for

provision of holistic healthcare. Holistic care skills are learned through a combination of theory and clinical skill practice. Experiential knowledge is knowledge gained through relationships and it has been argued that this learning is valid whether these relationships are with people, objects or places (Burnard 1987). However, not all clinical experiences can be guaranteed during the three years of healthcare degree education programmes or with CPD. So, finding ways to guarantee experiences is key to development of a confident healthcare workforce and the gold standard of healthcare.

2.9 Chapter summary

VR is a technology which can be offered as one of a range of educational tools used within curriculums to support individuals as learners within epistemological and ontological frameworks. It may also open doors for those who would be unable to attend learning sessions in person. Using VR to share learning with healthcare students and clinicians on a global basis will encourage education that is timely and relevant to the greater good. This can be seen when considering the benefits possible in terms of contribution to public health outbreak care such as with the Covid-19 pandemic, as well as teaching or updating emergency skills to healthcare students who are unable to attend sessions in person or unable to travel to distant educational settings to learn the latest evidence based best practice. The research included in this literature review has indicated that research needs to be done to explore the impact of VR simulations on non-technical or soft healthcare skills such as humanisation of healthcare, cross discipline generalisability, multicentric replication of impact from learning in the same VR simulation, user perceived learning transability / transference of learning to clinical practice, cost of VR simulations compared to value of educational gains, impact of VR on learning autonomy, validation from more large research sample cohorts, and research to explore which applications are most effective.

Although the literature review identified a number of research gaps (sections 2.7 and 2.8), a study such as this cannot seek to address them all, therefore this research will focus on the following gaps:

1. The impact of VR on holistic and humanised healthcare education.
2. The impact of VR on clinical intuition.

These research gaps will be discussed further in Chapter Four when this project's research questions are defined and discussed.

Chapter Three: The need for Virtual Reality Learning Environments (VRLE)

"We are no longer bounded by physical spaces and the physics of the known universe." (Scavarelli et al. 2020, p.257)

3.1 Introduction

This chapter focusses on the theoretical aspects of using VRLE in healthcare education. As discussed in Chapter One, healthcare students are comprised of a range of demographics including mature and younger learners. Meeting the diverse learning needs of cohorts comprised of hundreds of healthcare students requires innovative and pedagogically informed revolutionary solutions to long-standing problems. Healthcare students are expected to complete numerous competencies with regular benchmarks in order to demonstrate their improving care skills as their three-year degree programme progresses. Healthcare programmes are comprised of a combination of theory and practical learning with the split between the two determined by the discipline. For example, nursing and midwifery degree programmes must be comprised of 50% academic theory and 50% clinical practice shared model (NMC 2023a; NMC 2023b). These are generally taught in blocks of theory and clinical placements and thusly there can be large gaps between the learning of the theories and skills and the application and practise of the same in clinical practice placement blocks. As directed by the NMC (2023c) healthcare students experience their learning in a variety of ways, through the use of different teaching methods, including the use of simulation and clinical practice placements to facilitate their education. This chapter considers the definitions of VR, VW and VRLE as well as their place within healthcare education up to the point of beginning this research.

3.2 Definitions and the historical perspective

3.2.1 Defining VR

Before the historical perspective can be considered, it is important firstly to clarify definitions for VR, VW and VRLE. In the 1980s, a computer scientist named Jaron Lanier and friends are said to have founded the first VR start-up. Lanier subsequently developed 52 definitions of VR in his attempt to describe the infinite possibility of this technology. The following three are the ones best suited to define VR's flexibility in relation to this research project:

> Definition 15: "Instrumentation to make your world change into a place where it is easier to learn." (Lanier 2017, p.132).
>
> Definition 47: "The science of comprehensive illusion." (Lanier 2017, p.264)
>
> Definition 51: "The medium that can put you in someone else's shoes: hopefully a path to increased empathy." (Lanier 2017, p.299)

However, Chalmers (2017) urged that a balance be struck between considering VR as real or unreal. In particular Chalmers argues that virtual objects are genuine objects, albeit a digital version. Chalmers refers to this as 'virtual digitalism' and says we should not allow for virtual fictionalism (the belief that virtual objects are fictional), in order to reduce risk of marginalisation of the virtual experiences. Jones and Dawkins (2019) explored the potential of VR to elicit empathetic reactions to real life circumstances and concluded that it could offer unique perspectives and introduce people to new experiences. This is further endorsed by Falconer and Hunt (2019) who suggest that evidence from ongoing work to virtualise a historical archaeological site indicates that virtuality is an extension of reality rather than a virtual version.

3.2.2. Defining VW

When attempting to define VW it was noted that there is no encompassing or commonly used and accepted definition of this term, and particularity not for VWs such as SL and Active Worlds Educational Universe (AWEU) which are also being used for education. Bell (2008) and Schroeder (2008) both define VW as predominantly synchronous as do McKenna and Jones (2012) who also discussed the importance of avatars in creating a sense of self, place and presence. The importance of the asynchronous aspect which is equally important when accessing VR from an educational standpoint will be discussed later on in this section.

Girvan (2018) argued that an accurate and widely accepted definition for VW was important for education in order to facilitate the correct choices when considering which equipment needed to be purchased when offering education in VW. Girvan (2018) reviewed 88 articles in an attempt to define a term for VW and distilled the information contained within them to arrive at this new definition:

> "Shared, simulated spaces which are inhabited and shaped by their inhabitants who are represented as avatars. These avatars mediate our experience of this space as we move, interact with objects and interact with others, with whom we construct a shared understanding of the world at that time." (Girvan 2018, p.1099)

Figure 2 has been created based on criteria that Girvan (2018) listed as essential to a virtual world. A virtual world, much like a showstopper cake, needs to offer users all the best quality ingredients they could wish for to create an object they recognise, as well as optional extras in order to maximise the benefits received in the time they spend there.
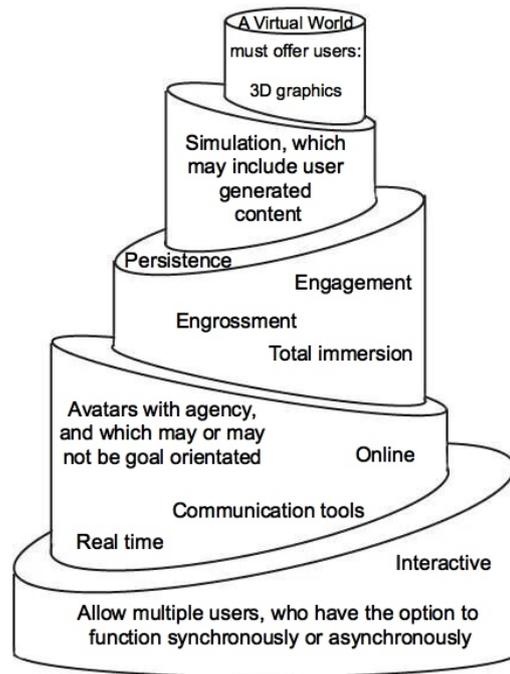
Figure 2 - (Author's own) Essential criteria for VW based on Girvan (2018).

Many universities maintain a presence in VWs (Castro 2019; Huttar and BrintzenhofeSzoc 2020; Duan et al. 2021) and there are indications that virtual space is being used successfully by HE for virtual field trips and tutor groups for courses of study (Silversprite 2014; Falconer 2017). Unfortunately, this does not seem to have translated itself equitably to consistent and sustainable use of VW and other aspects of VR for healthcare education. However, awareness of these benefits does not seem to have greatly increased the use of VW for healthcare education. Kirriemuir (2010) states that in the early 2000s the infrastructure required to use VW in education posed the most significant barrier. It could be argued that that this barrier has now been overcome because of the advancements in use of digital technology and the availability of Wi-Fi plus acceptance of laptops and iPads being used during in class time. Kirriemuir (2010) surveyed 110 UK universities in 2009 and found that over 90% were engaged in developing, teaching and learning or research work involving VW.

Within some VWs there is the added benefit of the user being able to learn asynchronously (individually and unobserved) as well as synchronously (with others for learning with the same or other professions). This asynchronous option offers benefits for the students who may feel less confident and do not wish to be observed by others while learning (Chauhan 2017). The future role of healthcare students requires them to work autonomously within a larger healthcare collective which they collaborate with as required in order to deliver optimum care for individual patients. Therefore, if can be

seen that both asynchronous and synchronous learning is of value for healthcare students.

3.2.3 Defining VRLE

VRLE can be defined as virtual reality environments where learning can take place if the student is in situ (Mukasheva et al. 2023). The virtual environment must be recognisable as relevant to the situation that is being taught and / or learned about where they can perform tasks with no risk to themselves or others (Cao et al. 2023). VRLE in the context of this research differ from Virtual Learning Environments (VLE) such as those where learning materials are stored without the student's presence being required in the VLE for the learning to take place.

3.2.4 Historical perspective

VR, in the form of VW has been used in education since 1997 when AWEU was first made available to users for them to build their virtual world in whichever way they chose in order to be used for education. Initially the education took place in the form of virtual seminars (Dickey 2002, de Fritas 2008). SL, which was launched by Linden Research Inc. in 2003, also has space known as islands in their virtual world. These are for sale to anyone wishing to build their own environment to use for various purposes including socialising and education. As mentioned above there are also VRLE available through platforms such as Daden Ltd. which launched in 2017 and offered free access to educators from 2020 in order for them to explore and experiment with developing and using VR for education. The important milestones in use of VR for HE have been summarised in Table 6 below.

Summary of important milestones in use of VR for higher education	
VR platform	Date of availability
Active Worlds Educational Universe (AWEU available for educational use (fee-paying options only)	1997
Second Life (SL) available for educational use (free and fee-paying options)	2008
Anyland and Manyland offers In-World Pick Authoring, In-World Building (free option) s)	2016
Daden Ltd. launched (available for education via user license option	2017
Mozilla Hubs - WebXR Editor App,Mesh Import and Placement (free)	2018
Daden Ltd. (free educator options and user license options)	2020
SineSpace made available for education (free option)	2020

Table 6 - Summary of milestones for use of VR in higher education.

Numerous advantages to using VW in education have been cited, including increased opportunities for collaboration, improved inherent communication and student engagement with the lesson (Dickey 2005; Bronack et al. 2008; Bai et al. 2012) plus more opportunities for teamwork compared to lectures and offering a platform for blended learning (Stephan et al. 2017). Also cited were more individualised benefits such as increasing learner empowerment, more personalised learner pathways, more opportunities for reflection (de Fritas 2008). VW were said to be a relatively risk-free environment to perform activities of learning in (Rogers 2011, Bailey 2012) as well as a valuable place to facilitate constructivist and experiential learning (Ata 2016). de Fritas (2008) predicted that VW would be in much wider use in educational contexts within the next five years of their report. Although students are being offered immersive learning opportunities at various universities, these are still intermittent, meaning the envisaged widespread academic use has not yet become a reality.

Williams et al. (2017) raise concern over VR being a misused term which they say is often used to describe technology which does not include the computer-based, interactive, three-dimensional triad that they feel is definitive of VR. Although it is understood that VR is distinct from VW in that users experience VR interactively within VW and other spaces such as VLE, there is a need to standardise definitions of all aspects of the virtual, and particularly in relation to ways in which it available for and for used for education. It would be inappropriate, for example, for healthcare students to expect an experience similar to gaming for pleasure instead of a healthcare-based learning experience within VR. I would argue that gaming should not be associated with healthcare where the aim is to achieve the best outcomes for patients and professionals alike. However, it can be accepted that learning within virtual environments has some game like features (Damaševičius et al. 2023).

3.3 VRLE situatedness in healthcare education

As discussed above, gaming does not have obvious relevance for healthcare education. Pezaro (2015) calls for education which reflects the clinical world in which healthcare students experience the practical aspects of their training and where there is increasing use of digital technology to support service improvement. Furthermore, it is important that students are being offered education that meets their needs and expectations as citizens of the digital world (O'Connor 2015; Risling 2016). Billet (2016) emphasizes the importance of healthcare students of being able to understand the healthcare user's perspectives when receiving healthcare and argues that this increases the student's motivation to apply themselves to their theoretical learning

related to clinical practice. Hodson (1998) argues that by scaffolding educational experiences, students are better able to associate the relevance of theory to practice. A study of 218 nursing students by Altun (2003) showed there are direct correlations between belief in problem solving skills and professional self-esteem. More recent research has also demonstrated a direct correlation between confidence in role associated skills (Gebreheat et al. 2022), leading to improved self-esteem which significantly contributes towards more effective and empathetic healthcare (Perez-Fuentes et al. 2019; Weeks et al. 2019). The solution therefore seems obvious – give students more opportunities to practice solving clinical problems in order to develop their clinical practice which will be beneficial to themselves and the people they provide healthcare to.

However, there are challenges to establishing clinical educational experiences in certain key areas of healthcare, such as safeguarding (WHO 2022; Divakar 2019). This is in part due to the often-hidden nature of these clinical concerns, the complicated and often convoluted care pathways, as well as the highly confidential nature of the situations. The learning environments need to ensure students are able to make connections between theory and practical learning. Students must be offered ways to tackle barriers to translating newly learned principles of theory into actual practice, or in other words a way to bridge this time lapse between theory and clinical practice. Furthermore, the Topol Review (2019) states that the pace at which healthcare is embracing digitisation means that someone beginning their healthcare education in 2019 will qualify in a world that is significantly digitally different to when they began their healthcare education. Therefore, educators need to prepare students to work clinically when they qualify and not just in the healthcare system as it exists at this time. This means equipping them with skills and tools to be digitally confident in key aspects of their healthcare provision.

However, this is not a simple task because the barriers are complex and healthcare programmes fail to fully utilise technology in the delivery of healthcare programmes for a number of reasons. Chiefly Loughlin (2017) argues this is related to the staff member's self-perceived but inaccurate lack of technological skills. Despite awareness of the numerous advantages demonstrated in respect of using technology for education (Pantelidus 2009), there has been relatively little development in this area. McGhee et al. (2011) argues that this was historically linked to the expense. However, the cost of developing and using Technology Enhanced Learning (TEL) has become increasingly affordable and mobile devices are now a part of the vast majority of student's lives (Chen et al. 2015). In many universities there is a dedicated team who work to increase

staff knowledge and confidence with use of TEL. Fernandez (2017) suggests that advances in technology for education should not be something that causes concern. These advances should simply be regarded as tools to enhance learning and improve student outcomes rather than making the focus on the devices themselves as these will soon be superseded by further advances in technology.

3.4 VRLE based skills and high-fidelity simulation mannikins based skills

VRLE facilitate and support the learning of unlimited students simultaneously if they are using the VRLE with an asynchronous setting. These students can be in different parts of the world, with no requirement for lecturer engagement whilst they are undertaking the learning or clinical skills practice. If students are learning in a VRLE which is set to have a synchronous view, then the simultaneous user limit would be the number that could fit in the same area in traditional reality in order to mimic working as a multidisciplinary team providing complex, urgent or emergency care. So, if the VRLE was focussed on an emergency in a home or a hospital room then the user limit would be the number of persons at which the users would feel crowded in traditional reality due to the similarity in sense of presence. VRLE class size view limits can be set so that an unlimited number of students can still be learning at the same time, but they can only see the designated people they are assigned to learn with in the VRLE.

In comparison, when learning using HFSM there are limitations to how many students can learn simultaneously and a lecturer is also required to be present during the learning session. The lecturer must be trained in operating the HFSM to maximise the scenario and minimise potential damage to the equipment. Due to visibility and hand-on requirements so that the skills can be practiced, there can only be a maximum of six learners per lecturer when using HFSM. The learning sessions must be in a skills lab when learning skills using a HFSM in a skills lab. This limits the availability of the learning to when the skills lab is open and staffed and increases the cost of delivering the learning.

Whereas flexibility of class size, learning style preferences and pace, as well as improving technical competence and confidence are highlighted as positive aspects of learning within virtual environments (Falloon 2009; Daden 2010; Miller 2014). However, there are also less positive aspects to learning with alternate (rather than traditional) reality which must be acknowledged:

- lack of equity between learners related to connectivity
- performance of their own equipment used to access the VRLE

- individual health issues which may impact negatively (particularly when head mounted display [HMD] equipment is required to be used)
- their technical competence - this needs to be at a basic level to use the VRLE for this research
- the cost to build and maintain VRLE

(Jensen et al. 2018; Radianti et al. 2020)

The first four of these considerations have been explored through data gathered in order to answer research question three. This has been discussed in detail in Chapters Six and Seven.

Current HFSM resources require ongoing expert simulationist practitioner-to-student F2F interaction to ensure high-quality experience, understanding, safe practice, assessment of competence and to keep damage of the HFSM to an irreducible minimum (Hallmark et al. 2021). VRLE can be used for learning without expert practitioner presence, though as discussed in Chapter 7 and Chapter 8, this research has demonstrated that provision of feedback during (7.3.1.2, 7.3.3.3) and after use (7.3.3.3) is valued by students. In Chapter 5 (section 5.6.1, 5.6.3) the way feedback is built into VRLE is detailed. F2F learning using manikins limits the possibility of sharing excellent teaching on a wider national and international basis, which disadvantages students who would otherwise benefit. Within VRLE there is the advantage of access to text-based theory teaching alongside the opportunity to practice the skills and receive feedback based on the students' performance. Additionally, this could be offered to potentially limitless number of students simultaneously. The implication of cost is considered in further detail in the licensing section (2.7.1)

3.5 VRLE as a form of pedagogy

VRLE in the context of this research project are offered as a computer-generated simulation of a real-life clinical workspace either in a pregnant woman's home, a community clinic or hospital, where students via avatars can interact with simulations of pregnant, birthing or postnatal women, their babies, their birth partners and other healthcare workers to practice a range of clinical skills from communication and documentation to complex practical skills. The VRLE can be experienced on smart phones, tablets, laptops, and VR enabled headsets. The research participants use avatars to interact with simulations of people needing healthcare, their families and other healthcare professionals to practice a range of clinical skills from practical hands-

on application to the more intuitive aspects of healthcare competency. This concept is supported by Woodford (2017) who defines VR as believable, interactive, computer-generated, exportable, and immersive.

Before this Green and Baird (2009) found that healthcare students enjoyed their learning in the clinical areas more than learning theory in the classroom. Understanding what this meant for delivering classroom teaching played a key part in the decision to turn the paper-based scenarios which had traditionally been used for teaching scenarios into a more immersive learning experience in the VRLE. It has been shown that there is a need to offer opportunities to increase the amount of time students can practice applying learned theory to their clinical skills: the key is to do so without reducing the mandatory time they must spend on learning theory. Barnard et al. (1999) claim that conceptive perspectives are key in directing our intellectual inquiry and determining the resultant judgments we make. Tafreshi and Racine (2016) adapted earlier work by Blenky et al., (1986) to create a table demonstrating the influence that learner's individual epistemological perspectives had on their concept of knowledge and of their ability to learn. Learners are categorized as the: 'silenced knower', who feels overpowered by learning; 'received knower', who prefers to learn from memorising other's knowledge; 'subjective knower', who prefers to learn through experience without necessarily planning; 'experience beforehand, procedural knower', who wants to find solutions to problems, and the 'constructive knower' who believes in the evolution of knowledge. Tafreshi and Racine's (2016) work portrays a wide variety of learning styles amongst groups of learners who are interacting with each other in a standard learning environment.

By recognising the importance of pedagogy in the clinical areas it could be argued that all healthcare students are social learners who learn best as part of the community to which they aspire to become bona fide members. Harnessing this knowledge by using Vygostki's (1978) socio-constructivist approach works well to capture the attention of those who prefer to 'learn by doing' (Mustea 2015). Personal experience with reconstructing the traditional classroom setting into a more social learning environment through the use of enquiry-based learning with the freedom to move, do group work, and experience simulation is one for which I receive positive feedback on a regular basis (mid and end of unit feedback). However, the issue of a gap between the learning of skills theory and opportunities to practice these in a clinical environment remains. Whilst Boud (1996) warned against educators taking responsibility for "enlivening" learning because this should remain with the students, it can be argued that developing VRLE is the modern-day equivalent to writing scenarios for students' use.

Kron et al.'s (2010) research with 217 medical students identified that 88% of the participants felt that many aspects of life, from personal to political, had moved online in recent years and as a result VR offered potential for healthcare education. Skiba (2015) talks about the training offered at Master's and Doctoral level for nurses in the United Sates that educates them in the use of digital healthcare tools. Curiously, the training showcased in the article includes subjects such as interprofessional communication, ethics, evidence-based practice and patient centred care; all of which it could be argued should be considered as mandatory competencies at undergraduate degree level healthcare education as it is here in the UK.

Additionally, it is important to consider why more healthcare programmes do not offer technology-based learning as a routine part of their educational delivery particularly when it can facilitate access to clinical practice opportunities (NMC 2023c). Peterson et al. (2015) highlight the importance of educator's willingness to be flexible in their teaching styles in order to explore capabilities that the learner may not be aware of. Vygotsky (1978) proposed that people learn through imitation of behaviours and Bandura (1989 cited in Jarvis 2010) conducted a series of experiments that found that humans learn though observing and copying others. Whilst it is acknowledged that the two are from different contexts and contrasting objectives, it is interesting that they both reached similar conclusions about how people learn.

3.6 Chapter summary

 The challenge for healthcare education is to ensure that the correct professional behaviours are being adhered to in the classroom and in the clinical environment. The historical perspective discussed in this chapter mapped the evolution of VR to the current position of offering itself as VRLE. In the context of healthcare education, VRLE combines the classroom pedagogy with the clinical practical application to create bespoke, profession generic learning experiences. Healthcare students can practice these in VRLE as frequently as required giving each learner a unique educational experience tailored to their individual needs, whilst ensuring the key principles are reinforced. It can be seen that VRLE can be suitably collocated with other tools for clinical skills healthcare education. The affordances of VRLE towards supporting practice holism of healthcare education is what will be explored in this research.

Chapter Four: Methodology

"No research without action, no action without research"
Kurt Lewin 1934 (cited in Adelman 1993, p.8)

4.1 Introduction

This chapter discusses how the methodological approach for this research was selected. The research purpose and objectives are explained in section 4.2. The research questions are detailed in section 4.3. The philosophical basis of the choice for mixed methodology is discussed in section 4.4. Section 4.5 focuses on the design of the research tools including brief detail of the concept testing activities which confirmed their suitability for use in this research project as will the research design, including sampling, recruitment, data collection methods and chosen method of analysis. The VRLE creation is discussed in more detail in the Chapter Five as it has been designed and created specifically as a platform for this research. Section 4.6 defines the complexities and importance of ethical considerations in relation to this research and the materials used for recruitment are detailed. Section 4.6 includes detail of the research participant recruitment along with discussion of the sampling strategy used. The connectivity and dynamic alignment of the theoretical underpinnings, mixed method data collection and analytical method can be visualised in the chapter mapping depicted in Figure 3 below.
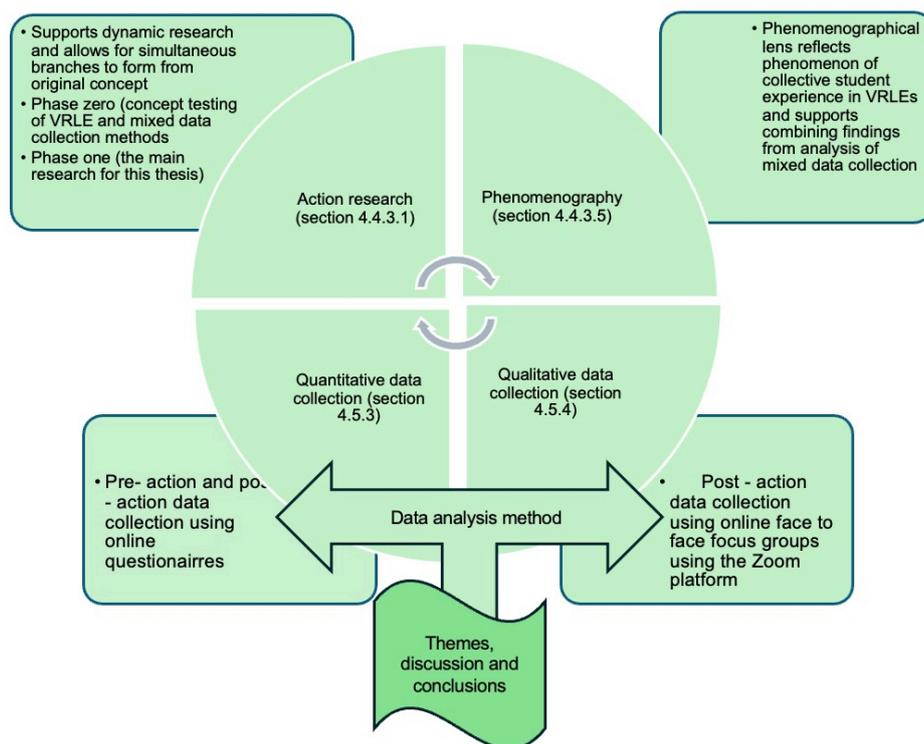
Figure 3 - Map of methodology chapter alignment.

4.2 The research purpose and objectives

4.2.1 Research purpose

The purpose of this research is to explore the impact of VRLE on the theory and practice of clinical healthcare skills in order to determine the potential of VRLE for use as an additional tool for teaching, learning clinical theory and practice. The aim is to scrutinise whether VRLE has value in delivering theory and specific clinical experiences that relate to humanisation of healthcare and development of clinical intuition. This is because certain experiences, for example specific safeguarding situations or clinical emergencies, cannot be otherwise guaranteed within traditional healthcare education. For this reason, the VRLE developed for this research are focussed on safeguarding families and can be used by all healthcare students regardless of their profession or level of study.

4.2.2 Research objectives:

The following three research objectives have been generated from the gaps discovered in the literature review and are defined below.

4.2.2.1 Objective one

To explore the impact of learning with the VRLE in relation to development of clinical intuition:

The literature review highlighted that there is a gap in research exploring if clinical intuition can be practiced within VR. Clinical intuition is not a finite skill (Stolper et al. 2011). Instead, it is comprised of a myriad of 'soft' skills such as compassion, communication with women during episodes of care, communication with multidisciplinary colleagues, ethical awareness and more (Benner 2004; Barnfather 2013; Zary 2019). In addition, for students to be confident in their ability to utilise clinical intuition, they must also be competent in the 'hard' clinical skills such as those which involve the physical application of their knowledge; for example, physical measurement / assessment of client wellbeing, clinical reasoning, documentation, and understanding of equitable care provision (Lyneham et al. 2008). Therefore, for the student to demonstrate increased confidence as a result of VRLE use they need to feel that they have improved healthcare skills as a result of their learning experience within the VRLE. Confidence is irrevocably linked to clinical intuition (Keene et al. 2022) and therefore this will be explored as part of the findings in objective one. In order to be able to utilise their clinical intuition students need to incorporate the 6 Cs (Cummings 2012) into their healthcare provision.

4.2.2.2 Objective two
To investigate the impact of VRLE use on healthcare students' humanisation of their healthcare:

The perception of students about the quality of their learning will be investigated to determine whether healthcare students feel that the time they spent in the VRLE was of benefit to their subsequent clinical practice, particularly in relation to honing the humanisation of their healthcare Todres et al. 2009). This research will also consider what the resultant implications are for future healthcare pedagogy and clinical practice in relation to the impact of clinical intuition and humanisation of healthcare in order to contribute to the knowledge base (Fasanelli et al. 2017; Curtin et al. 2019).

4.2.2.3 Objective three
To consider the impact of VRLE functionality on the overall learning experience:
It is recognised that use of VRLE as part of the curriculum for healthcare students in order to bridge the gap between provision of a consistent approach to theory and offering space to undertake clinical practice is ground-breaking technology and the overall functionality is not always trouble free. For this reason, consideration of the impact of technological challenges on the quality of healthcare students' learning experience is an important aspect to be explored (Gray et al. 2023). This will support understanding of the affordances of using alternate reality for education, in particular the impact of VRLE on users' ability to connect with the virtual scenario (Kononowicz et al. 2019). Data provided by this research will support generation of a well-rounded conclusion.

4.3 The research questions

The research objectives generated the following research questions which overall will explore the impact of VRLE on offering space for learning clinical theory and clinical practice for development of holistic healthcare skills.

1. What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?
2. To what extent does healthcare students use of VRLE impact on the humanisation of their healthcare?
3. To what extent does the VRLE functionality impact healthcare students' perception of their ability to engage with the given scenario?

4.4 The Philosophical Framework and Methodology

4.4.1 Rationale

The underpinning rationale for this research was a recognition of a need to explore the impact of VRLE on healthcare students' learning experience and transferability to their clinical practice. Healthcare students can struggle to gain required clinical experiences which cannot be otherwise guaranteed in standard clinical practice. VRLE were a proposed solution to this challenge because they allow for immersion in clinical scenarios and therefore students should be able to apply theory to clinical practice of healthcare skills. A multi-strategy blend of quantitative and qualitative data collection was utilised because it is representative of the gold standard holistic healthcare which combines the art of caring with the practicality of applied science (NMC 2018b).

4.4.2 Pragmatism as a philosophical framework

Pragmatic researchers are defined as those who prefer to act rather than philosophise (Morgan 2014). They view truth, meaning and knowledge as dynamic forces, consider that the value of the physical world is equal to that of the psychological world and endorse practical theory (Johnson and Onwuegbuzie 2004). This multi-strategy perspective enables the blending of quantitative measurement of the data with qualitative data during analysis and this will be discussed in more detail in section 4.5. In order to introduce actions, consider the data, adjust the action and generate conclusions related to concepts which are most significant and impactful for student learning and future practice, a combined approach of action research and phenomenography was chosen (Bruce 1999; Akerlind et al 2014). This pragmatic approach is well suited to this research process which has gathered quantitative and qualitative data, from which conclusions have been drawn individually for each and then considered again when the results were considered as a combined data set. There were a number of methodologies which were considered in relation to their positive and negative aspects related to this research project as a whole (Appendix 4). In particular, ethnographic, phenomenological and grounded theory approaches all had some qualities which are suitable in part for this research. After careful consideration it was decided that action research was the most appropriate choice for this research. Action research offers flexibility and ability to be responsive to RPs feedback in order to strategize, make positive changes and even innovations related to the project whilst the research is ongoing for the original design (Trevitt 2005; Somekh 2005).

4.4.3 Action research viewed through a phenomenographical lens

The methodological approach chosen for this project was action research viewed through phenomenographical lens using VRLE as the venue for the RPs' experience. Phenomenography is recognised as providing the flexibility to frame both quantitative and qualitative data (Feldon et al. 2018). There is support for the use of mixed methodology research (Roberts 2003; Feldon et al. 2015) although the need for separate analysis is emphasised (Beck and Gable 2012; Bahena et al. 2016). Phenomenographical action research is an emerging approach which incorporates both these methods when considering the generated data in order to maximise the knowledge improvements offered from the research (Beaulieu 2017). In order to define the value of each methodology to this research, action research and phenomenography will be discussed separately.

4.4.3.1 Action research

Action research embraces flexibility and responsiveness by using dovetailed cycles of research and then action to implement change(s), followed by further research into impact of the change, these cycles are key characteristics of what defines action research (Dick 2007; Kemmis and McTaggart 2000; McNiff and Whitehead 2010). Action research is used routinely within healthcare education from feedback provided mid-unit by students to inform the delivery of the remainder of the unit and post-unit feedback is used to inform future unit development. Action research is also utilised in healthcare education units dedicated to multidisciplinary service improvement projects (SIP). These SIP projects are cocreated and developed by students with support from the teaching team and service stakeholders. The students need to work collaboratively to decide on a project which would benefit healthcare services, discuss this plan with stakeholders, design it and suggest ways in which it could possibly be implemented. Additionally, action research is used for long-term dynamic research such as this project.

The literature review identified gaps in knowledge around whether clinical intuition and humanisation of care could be practiced within VR. The feedback from the prototype testing showed students were aware of clickable aspects / options within the VRLE. This insight was used to determine how clinical intuition use might be explored and the resultant action was to have a gut instinct button and alarm bell built in the VRLE for this main research project. This research explored whether these features supported the RPs to explore, test and develop their clinical intuition skills. To explore the viability of healthcare students practising skills of humanisation of care within the VRLE, the scenario storyboards included aspects which would necessitate having to consider how to demonstrate the values required to humanise healthcare. These values are known

as the 6 Cs of healthcare: care, compassion, courage, communication, competence and commitment (Cummings 2012). As a registered midwife and registered midwifery lecturer, action research is a suitable framework for research into healthcare education innovation (Robson and McCartan 2016; Verma 2021).

4.4.3.2 Concept testing as part of my action research
Phases and branches

Appendix four differentiates between the two different phases of my research on VRLE. Phase zero was part of my work as an academic, practitioner and researcher that led me to begin the phase one doctoral research that this thesis is written about. Phase zero is not part of this doctoral research but was an important step towards it. Phase zero was an essential pre-research study on VRLE use for urinalysis. Hard clinical skills practice in VR has already been extensively researched as discussed in the literature review (Chapter Two). However, by creating a basic VRLE for hard clinical skills practice I was able to test a version of the intervention tools used for this doctoral research, to practice my conduct as a researcher and contribute a hard skills VRLE to the package of learning tools we offer our healthcare students. In this thesis I refer to that VRLE as phase zero (Appendix 5).

Phase one is the action research cycle that relates to my research for this doctoral thesis. It is comprised of two safeguarding VRLE which incorporate practice of hard and soft skills, are profession generic and topic specific. Phase one VRLEs for safeguarding offer healthcare students a place to experience clinical situations, assess, plan and implement care which cannot be guaranteed as part of their clinical practice placements.

In addition, there were two branches that formed, one in phase zero and one in phase one. Both branches are described within this thesis as they evidence the value of action research as a dynamic tool for innovation with a continual and changeable life cycle. This can be seen in 4 on page 79, which highlights phase zero and the branch for phase zero in grey whereas phase one is highlighted in cyan and the branch for phase one is highlighted in blue.

Concept testing

Prior to undertaking the research for this Doctoral thesis, healthcare students were asked to concept test a prototype VRLE (phase zero, discussed in detail in Chapter Five, section 5.6.6). That VRLE offered opportunities to practice clinical skills for urinalysis which were predominantly hard skills along with a few soft skills to practice.

These healthcare students were asked to provide quantitative and qualitative feedback on their experience (Appendix 8 and 9). They were encouraged to suggest changes that they felt would enhance their experience. This feedback provided valuable information with which to action in the form of further development of VRLE which were the ones used for this research project. The findings from the concept testing (phase zero) offered unexpected perspectives such as that there was a desire for VRLE which facilitate the practice of soft clinical skills such as humanisation of healthcare and clinical intuition. The phase zero findings also demonstrated that changes were needed in the phrasing of the quantitative data collection questions to avoid confirmation bias. These findings were reflected on and then acted on by rewriting some of the quantitative data questions. These changes were then observed through discussion with the RPs to check that they agreed that the necessary changes had been correctly understood and made.

Additionally, the concept testing prototype (phase zero) showed that more frequent reminders sent in a variety of ways were needed to reduce attrition during quantitative and qualitative data collection so further action was taken to address this issue. Another developmental change identified and acted upon was in relation to the timing of the access to the VRLE action as well as subsequent quantitative and qualitative data collection segments. These changes were implemented in order to avoid conducting research during times when students were in clinical practice placements which the RPs' felt would improve their engagement with the data collection. This was confirmed by reduced attrition and improved comprehensive contributions during the main research data collection. This in turn improved the rigour of the research as there was a diversified pool of data from students representing a number of healthcare disciplines from which to generate robust conclusions. This cyclic integration of investigating an educational action followed by applying and evaluating the action is recognised as crucial to action research (O'Leary 2004; Duchi et al. 2023).

The plan, act, observe, reflect, for phase one (this doctoral thesis's research project) and phase zero (concept testing) is more fluid than it appears in this linier text-based description in this section and in 43. As demonstrated above, the unique continuum of action research benefitted this project because action was taken based on the experience feedback contributions from the healthcare students who had used the concept testing prototype (phase zero, Figure. 4). This feedback was acted on by creating a more refined version of the VRLE scenario until the main research project VRLEs for safeguarding were created (phase one, Figure. 4). These VRLE included aspects for which research gaps had been identified as part of the literature review.

Action research is unique in that it is part of a continuum of itself with research evolving iteratively to become improved versions of itself as well as occasionally becoming something new which is best depicted as a network of branching spirals (McNiff 1984). McNiff and Whitehead (2010) state that action research can generate transformational branches which arise from the main action research spiral. This was experienced during phase zero whilst performing the concept testing when the findings led to a call for VRLE to be used and imbedded in the current curriculum of that time (phase one, this research). The concept testing VRLE also evolved into use as a clinical space for assessing students' skills for urinalysis (phase zero, branch one) during the time when first year midwifery students were not able to go into clinical practice because of the Covid-19 pandemic restrictions.

Moving on from the changes arising from the concept testing (phase zero, discussed in Chapter 5, section 5.6.6) and implemented prior to beginning this full research (phase one, safeguarding VRLEs) an additional VRLE was identified as requiring development while this research was in progress. A previously considered VRLE which focussed on recognising, planning, and delivering coordinated, time critical, multidisciplinary complex emergency care was identified as something healthcare students desired as a matter of urgency. Funding was available and therefore a postpartum haemorrhage (PPH) was created and implemented for trial use within the curriculum (phase one, branch). This PPH VRLE was developed whilst the research for this project (phase one) was ongoing and is discussed in more detail in Chapter Eight. The different phases of the action research for this project (4) have been mentioned in order to highlight and demonstrate the dynamism of action research and how actions which are dichotomous can coexist within the research spiral.

This branching spiral of generative transformational process in 4 below summarises the branches that formed during the action research spiral for this project. Full detail of these elements is in Appendix 5 in list and table format.
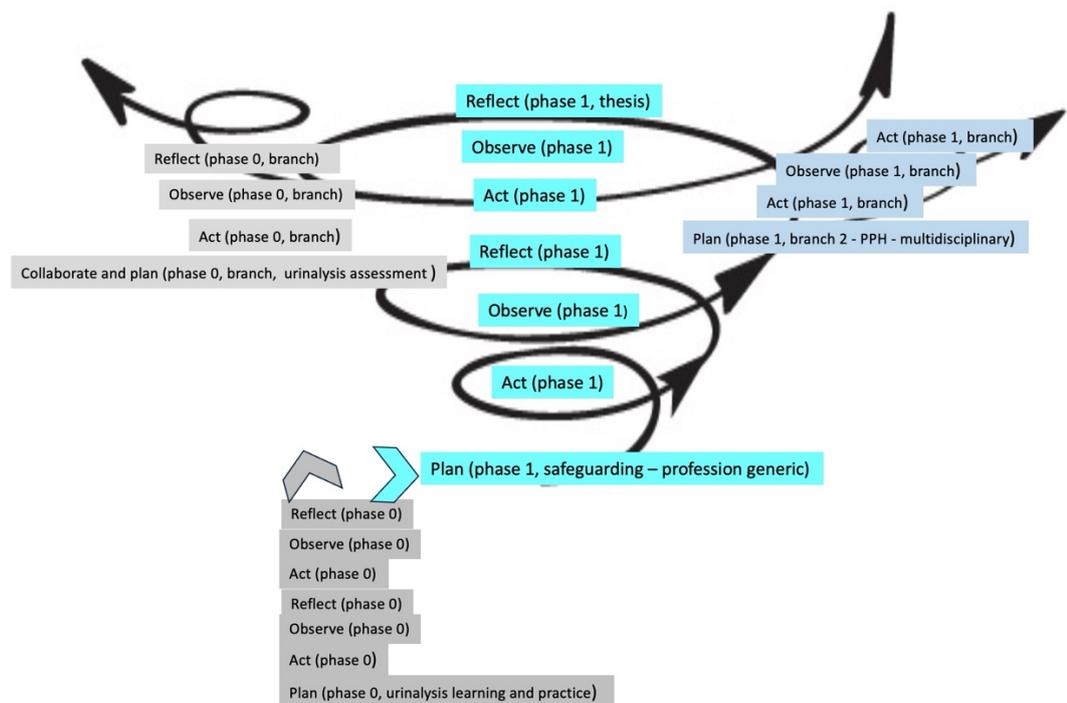
Figure 4 – Author's own adaptation of McNiff and Whitehead's (2010) action research spiral.

The VRLE used for this research project were designed to challenge RPs to explore healthcare theory and clinical practice which was offered in a different format to traditional classroom and ward-based pedagogy. The need for and creation of the VRLE is discussed in Chapters Four and Five. During the creation of the VRLE (discussed in detail in Chapter Five) feedback was gathered from multidisciplinary clinical colleagues on the suitability of the profession generic safeguarding scenarios which had been written for this research. Additionally, RPs communicated and discussed their experience through contribution to the quantitative and qualitative data collection, so that improvements to clinical practice learning opportunities could be made (Winter et al. 2001; Meyer 2006; McNiff and Whitehead 2010).

The VRLE offered clinical practice experience in new ways alongside traditional clinical practice teaching pedagogy. During action research, hypotheses are allowed to emerge into confirmed beneficial actions while the research is ongoing, thus allowing it to evolve organically in a progressive way (Waterman 2001). During the concept testing (phase zero), RPs' identified aspects within the VRLE in which they felt their skills in humanisation of healthcare were being improved. They highlighted these as being perceived to be of particular benefit to themselves and healthcare service users. These learning opportunities were then enhanced and multiplied in the safeguarding

themed VRLE used for this full research project and the hypothesis that VRLE could have an impact on the humanisation of healthcare was generated.

As the researcher for this action research project, it is appropriate that I am a qualified registered midwife and HE teacher because I am therefore an insider researcher aiming to identify new ways to teach and learn clinical theory and engage in clinical practice. McNiff and Whitehead (2009) highlight that the action researcher needs to be engaged on a personal level as an insider researcher in order to be accountable for their own actions. They state this leads to new knowledge and action and this proved true in relation to this research project. Changes to the midwifery pedagogy arose as a result of the concept testing (phase zero, discussed in Chapter Five), which required me to be accountable for in order to support the team to familiarise themselves with using the VRLE during their teaching and assessing.

It is also recognised that there are risks associated with being an insider researcher such as that of confirmation bias and assumptions of human behaviour based on previous professional experience (Floyd and Arthur 2012). Though this could equally be a benefit when needing experience to draw upon for encouraging detailed feedback during qualitative research. Additional insider researcher risks are maintaining organisational confidentiality and potential negative impact of research outcomes (Fleming 2018). These have been considered and safety measures were in place as a result. These are discussed in section 3.6 of this chapter.

The flexibility of action research has been proven to be of value from the concept testing prototype (phase zero, Appendix 5) which contributed to the design of the VRLE for this research and also for the creation of an emergency procedures specific VRLE (phase one, branch) which supports multidisciplinary synchronous and asynchronous engagement. However, in order to refine the approach so that the focus is on the collective opinion for this research, the qualitative observations, feedback and reflections will be viewed through a phenomenographical lens.

4.4.3.5 Phenomenography
Phenomenography is explained as a qualitative research approach that retains the nondualiity of research participants, and which does not study reality per se but rather people's perceptions of reality, therefore sustaining the belief that the subject and object are irrevocably linked (Webb 1997). It is argued that using phenomenography in the context of action research will provide a useful lens through which to consider meta-themes in order to encapsulate the collective perception of an experience (Cherry

2005). Beaulieu (2017) goes one step further and proposes that when action research is "infused" with phenomenography it increases the potential for deep understanding of diverse opinions about the same experience.

The essence of my research is the exploration of the healthcare students' collective experience of learning within the VRLE action as viewed through the methodological lens of phenomenography. Thusly, my research design draws on principles of the phenomenographical approach because it explores the RPs' perceptions of learning virtual reality in comparison to previous experiences of learning in traditional reality. It is therefore a suitable lens through which to consider the exploration of the phenomenon of collective student experience in VRLEs. Micari et al. (2007) suggest that this affords a unique opportunity to contrast and compare learning experiences. This comparison can then be analysed in order to generate collective themes from the data. Consequently, examining the conceptual, experiential, cultural, and other unique ways of relating to the experience can be embraced as a whole. Thereby generating more holistic insights towards a collectively experienced problem such as the inability to guarantee certain clinical learning experiences which is the basis for this research.

Barnard et al. (1999) state that phenomenography is important for healthcare research because it helps to gain an understanding of the phenomenon that individual patients experience the same healthcare episode in unique ways. It can be argued that this is uniquely important to healthcare students who must practice clinical care with the ability to undertake empathetic consideration of what the healthcare episode must be like to experience for a healthcare service user. It is this individual yet collective experience that gives rise to a generally understood opinion about healthcare episodes. For example, some women will only need to have their pain eased during childbirth whereas others will need complete pain relief. Although each woman would describe the pain of childbirth differently, they are all experiencing pain during childbirth. Therefore, they would agree that childbirth is a painful experience.

The fact that we can have different understandings of the same experience, which in turn gives rise to a shared new understanding of the whole experience, is an example of individualised yet collective (nondual) intellect which is also known as a phenomenographical perspective. The way new understandings are utilised in relation to the labour pain women experience is the action expected as part of action research. When viewed through a phenomenographical lens the action should be impactful for as many women as possible. For example, if research indicated that most women had a less painful labour in dimly lit room, then an action from the research could be to add a

lamp to each labour room so the main lights could be switched off. It is this understanding of action research viewed through a phenomenographical lens that I have used for this research project.

Although an example of maternity care was used above, the phenomenographical lens resonates with any healthcare profession where individuals go about their duties as autonomous practitioners. They are working collectively to attain the same goal; upholding the image of their professions through betterment of the wellbeing of patients in each episode of care. This can be demonstrated more succinctly as a Ven diagram in the classic pretzel / hug shape of the Scandinavian pastry called a Kringle (Figure 5).
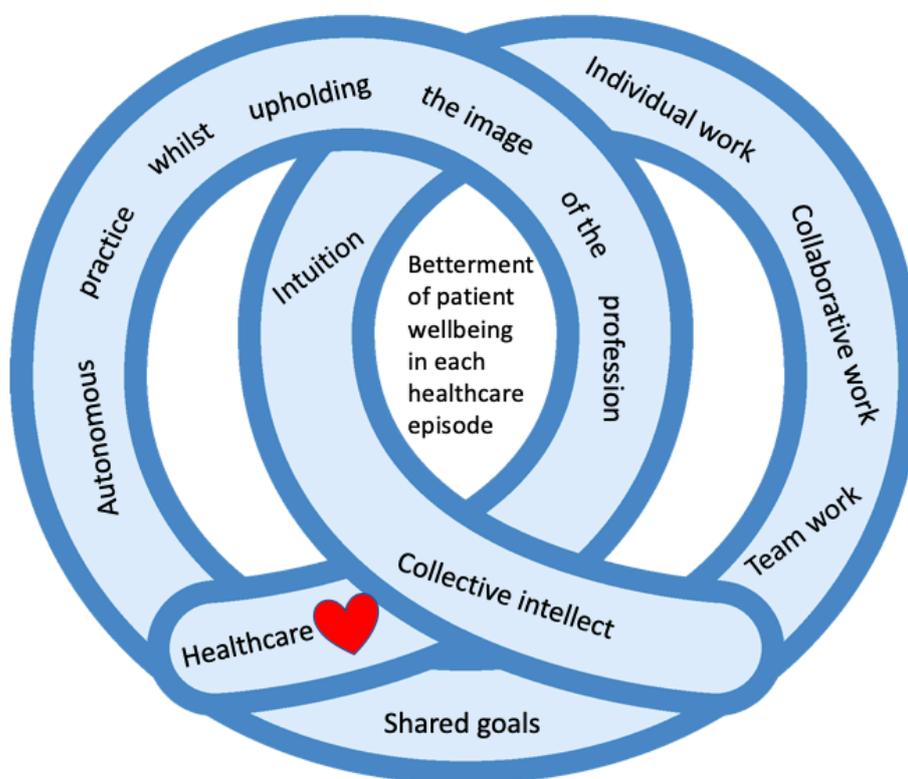
Figure 5 - Author's own Kringle Ven diagram (King 2019)

By exploring the RPs' collective experience within the action (VRLE) conclusions will be drawn from analysis of the insight provided. The reactions of RPs to their own behaviour and the way others react to them has resonance for this research project which considers whether the VRLE is perceived as 'real' enough to allow healthcare students to benefit from using it to learn theory and practice their clinical skills within the VRLE (Schwandt 1998; Weaver and Olson 2006).

Phenomenography also embraces the integrated paradigm of utilising quantitative and qualitative data (Felton and Tofel-Grehl 2018) and retains the nonduality of the RPs by focussing on the collective intellect (Marton 1981; Marton et al. 1997) which is adjunct to the chosen action research methodology. This combination of action research considered in a phenomenographical way will facilitate the generation of contextualised conclusions. This is because the combination allows for integration of both quantitative and qualitative methods, which will in turn add more credibility to data findings, analysis and conclusions.

4.5 Methods of Data Collection and Analysis

4.5.1 Pragmatic data perspectives

The multi strategy data collection approach is defined as occurring when the quantitative and qualitative research techniques, methods, approaches, concepts or language are combined into a single study (Wolff et al. 1993; Burke et al. 2004). The combination of quantitative and qualitative research will ensure that the data collected provides the framework to support consideration of the opinion of the majority of the RPs in relation to how they perceive the VRLE experience and what changes are desired by the most (Feldon 2018).

The qualitative researcher believes that people hold multiple perspectives and do not exist within a single reality, and therefore undertaking qualitative research will produce data which results from their personal experience (Rees 2011; Creswell 2013). This approach can also be defined as the Heideggerian concept or Hermeneutics and is one which values research findings centred around understanding human self-awareness, the RP's sense of presence, and of their interaction with others (Fry 2016). Healthcare students learn both as individuals and within educational partnerships with classmates, teachers and clinical supervisors (NMC 2009). These pedagogical parallels allow healthcare students to explore different ways of performing aspects of healthcare and to develop their individual healthcare delivery techniques to use as future professionals. Therefore, it is important that the findings from this research considers the qualitative aspects of their experience and reports on the RPs' multiple realities of learning by collecting data on how individuals in the same study translated their experience differently. This combined approach of gathering quantitative and qualitative data is therefore ideally situated as a complimentary dyad within this research project and ensures the ensures the healthcare circle can be fully drawn (Hibberd 2001).

The quantitative perspective will allow for measurable data to be collected in order to identify patterns in the RPs experience which is an important aspect of healthcare that on its own would be inadequate for this research. The limitations imposed by the rigidity of this approach when measuring human experience does not offer the flexibility required to encompass individual perspectives (Baharein 2008). However, this has been resolved with the addition of qualitative data collection. Jones (2004) argues that quantitative and qualitative research are connected and should be used in combination more frequently.

The quantitative data was collected pre- and post-action with subsequent exploration of the qualitative data collected by focus groups as well as the qualitative feedback provided in the open text boxes for each question of the pre and post action questionnaires. The pragmatic combination of qualitative and quantitative methodological approaches facilitated the development of causal relationships between the art and science of healthcare which was under investigation by this research. It also supported exploration into the impact that use of VRLE has on the holistic healthcare expected to be provided by healthcare students.

To summarise, data collection for this research proceeded in the order listed in 6 below.
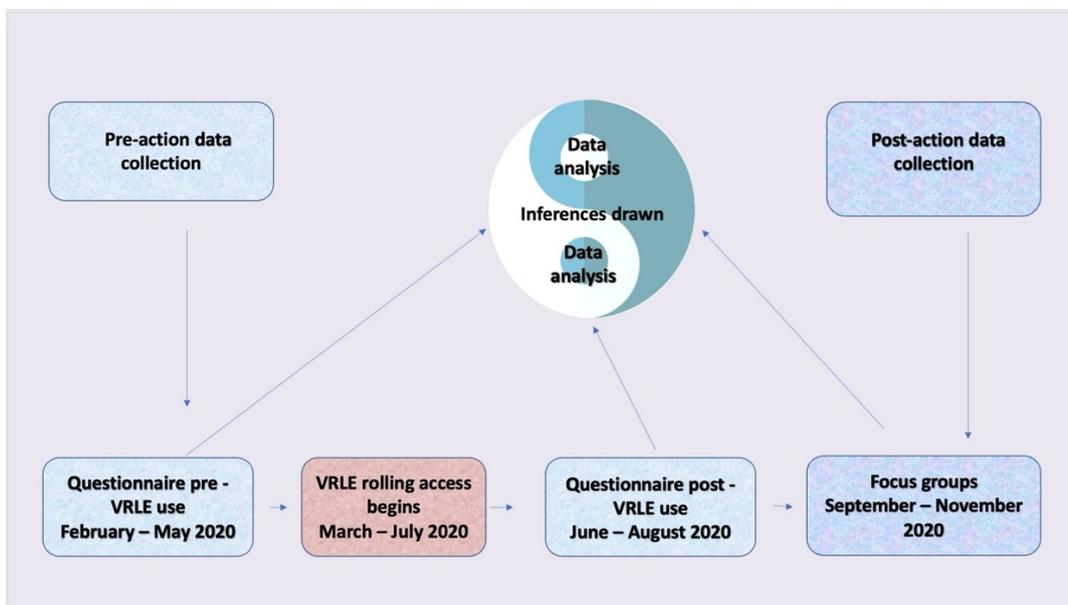
Figure 6 - Order of data collection in phase one.

4.5.3 Online questionnaires
Pre-action questionnaires were used to establish a baseline in RP's beliefs about using VRLE to learn and practice clinical intuition, humanise their healthcare and confidence

in using VRLE as a learning tool. Change in their belief after using the VRLE was measured using another questionnaire (Scott and Mazhindu 2014; Kruyen et al. 2014). The RPs were able to contribute their responses anonymously in order to increase the likelihood of RPs having the confidence to be honest when feeding back about their experience (Ong and Weiss 2000). Open text boxes were included as part of each question in order to offer the option of an anonymous spontaneous response to each question (Kumar 2014). It is acknowledged questionnaires can only collect data that is specific to the time when the RPs are answering the questions (Davies and Hughes 2014), however the data collection is being continued qualitatively post action using focus groups after a time delay.

The questions asked were limited to 13 for the pre-action and 14 for the post action feedback in order to maintain the RPs motivation to answer without the process being too time consuming (Jacobsen 2017). The questions which are not relevant to the research questions included confirmation of consent, exploration of previous experience with technology and VR on the pre-action questionnaire and how many times and how long were the VRLE used as well as on which devices post-action. The questions were created specifically for the purpose of this research because previous research using VW for healthcare education did not state which questions had been used or had explored different aspects.

Therefore, these could not be repurposed as previously validated questions for this research (Chow et al. 2005; Bailey 2011; White 2016). Research by Pramod et al. (2016) indicates that online surveys are an effective way to collect data because their accessibility means RPs can contribute their information at the time and place of their choosing. However, Kara (2012) posits that while online surveys offer many benefits as a method for gathering quantitative data as well as some qualitative data, there are also disadvantages to using this method, including using questions which have not been previously validated in other studies. Furthermore, Cohen et al. (2007) dispute the need to use validated research questions by arguing that research is already self-validating through the use of experience and already has a built-in process to detect errors through routine analysis by other professionals of the same discipline. Interestingly, Hall (2012) proposes that RPs can verify the quality of the data collection, which in turn will validate the method used.

The final content for both the pre-action and post-action questionnaire (Appendix 5 and 6) was the result of a development process which took place during the taught phase of this doctorate. The changes to the pre-action and post-action questionnaires were

made during the concept observation (phase zero) where the questionnaires were piloted for useability, functionality and reliability (Appendix 8). These changes were found to be needed in order to add clarification and prevent the risk of confirmation bias. As well as avoidance of leading questions, the final questionnaire format included a logical flow to the questions without branches and a mix of open and closed question styles to keep the RP interested in answering (Burgess 2001). Both questionnaires were developed with the aim to gather the necessary data by asking as few questions as possible, in order to maximise RP's motivation to answer all questions asked (Jacobsen 2017).

The final versions of the pre-action and post-action questionnaires were designed to gather data which will establish quantitatively the extent of the impact use of VRLE has on use of clinical intuition, the extent of impact on the humanisation of their healthcare and the extent of the impact of VRLE functionality on engage with the scenario. The questionnaires also had some questions which seek to establish the RPs' level of confidence with using technology and their belief in the value of using VRLE for learning in order to determine a baseline to measure if these aspects had any impact on their experience. The quantitative data gathered from the questionnaires formed the outline to answers for all three research questions which was then enriched by the collection and analysis of qualitative data.

4.5.3.2 Data collection timings

The RPs had one month to complete each questionnaire with weekly email reminders of the survey's closing date. There was rolling enrolment for the questionnaires between February to May 2020 for the pre-action and June to August 2020 for the post-action questionnaire. The RPs were given one month to use the VRLE during March to July 2020 and were not able to access the VRLE until they had completed the pre-use questionnaire. This is likely to have increased their motivation to complete the questionnaire according to Hoerger (2010) who found that on average 10% of participants can be expected to drop out of research soon after it begins. Eysenback (2005) warns that attrition rates will increase if participants are not engaged and actively using the project being researched. McPeake et al. (2014) state that email reminders increase survey response rates and that at least two should be sent though they did not indicate the recommended interval between these reminders. Van Mol (2017) recommended sending four reminders within a four-week period with the first two being sent in the second week. Avery et al. (2006) state that female RPs are more likely to respond than males and the majority of my RPs were this gender which increased my confidence of a high response rate. However, I was also mindful of

Adams and Umbach's (2012) research findings related to email and survey fatigue which highlighted that those which arrive last will contribute to chance of fatigue.

Therefore, it was decided to send weekly email reminders of the VRLE experience closing date and the date by which the post-action questionnaire needed to be completed. These were sent on different days of the week and different times of the day to the previous week in order to maximise the opportunity to keep the RPs agreement to participate in this research fresh in their minds and reduce the risk of email and survey fatigue. As part of these weekly reminders, they were also sent reminders of links to doodle polls which listed focus group dates, so they could choose a date which suited their commitments in order to be available to contribute their valuable feedback in further detail via focus groups. This process was successful compared to the concept observation (phase zero) when email discussion was used to try and agree a suitable focus group date which was much more challenging and time consuming. During the concept testing there was a 50% (19 down to 10) attrition rate between pre- and post-action questionnaires and during this full research project there was only a 12% drop out rate (311 down to 253) between pre- and post-action questionnaires.

4.5.3.3 Quantitative data analysis and limitations

The quantitative findings were analysed using the Statistical Package for Social Sciences (SPSS). Using SPSS supported analytical inferences to be made from the data, including some which are generalisable for the healthcare student population. The sample mean and sample standard deviation pre- and post-action is able to be produced using SPSS. These values can be linked to confidence intervals which give boundaries to the margin of error and allows inferences to be made in relation to the RPs data compared to the general healthcare student population (Smith 2023). However, there were limitations latterly noted with the quantitative data collection instruments. The quantitative data was collected using questionnaires hosted on the Jisc Online Survey (formerly BOS) platform which allows RPs to respond anonymously by following a uniform resource locator (url) to the survey and then entering a shared password. This meant the data was anonymised at point of entry before the researcher was able to see the RP contributions. This and the shared RP questionnaire password caused a limitation in the analytic options for the quantitative data as the RPs could not be tracked from pre-action to post-action questionnaires.

There were also different sample sizes contributing to the pre-use and post-use questionnaires. These differences were adjusted for by SPSS analysis in various forms

depending on which were most suitable for the question format (Scott and Mazhindu 2014; Kara 2012; Smith 2023).   An additional limitation was that some question's answer options allowed RPs to choose "other" as an additional option. This meant that some appear to end up with more than 100% response rate due to those people including open text detail related to their answer choices. A workable solution was found by not including the "other" option choices in the SPSS analysis. The additional information provided by RPs who chose to use the "other option" is considered during the analysis for both quantitative (Chapter Six) and qualitative (Chapter Seven) analysis discussions.

Making links between quantitative and qualitative research data is considered to be a valuable way to enhance knowledge (Srnka and Koeszegi 2007). This combination will make allowances for the fluidity in perception of the RPs' experience while learning within VRLE that may naturally arise during this time continuum. Qualitative data also encapsulates the consolidation of their experience as RPs and the process for collecting qualitative data is discussed next.

4.5.4 Online focus groups
Qualitative research is described as research which seeks to understand phenomenon which is not as yet fully understood, is linked to humanities and is situated within holism (Strauss and Corbin 1990; Tesch 1990; Husen 1997). As discussed in section 4.4.3 and 4.4.3.2, the complexity of healthcare research means that quantitative data needs bolstering from a phenomenographical approach. An open forum was used in order to gather qualitative data and add depth to the quantitative data. Using surveys to collect data alone would not give full replicable measure due to individual communication preferences (Qiu and McDougall 2013). Focus groups have value in generating new ideas and helping the researcher to understand the RPs' experience, enhance understanding of experiences through group dialogue and identify group norms (Holloway and Wheller1996). The benefits of being able to expand on and explore areas where individual experiences differ as part of open conversation is preferable for this research than one to one interviews where these differences in experience cannot be noticed or discussed collaboratively with the other RPs in real time (Kitzinger 1994). Furthermore, early forays into virtual focus groups (group email) by Murray (1997) recommend use of focus groups as a more welcoming space for those who might be uncomfortable with being interviewed as an individual and, in particular, for sensitive issues such as abuse survivors.

Along with the value of online focus groups for discussion of sensitive matters this platform for focus groups also offers other benefits. Turney and Pocknee (2005) conducted virtual focus groups using the Blackboard platform and noted the value of virtual focus groups for overcoming issues related to geographical distance between participants. Rupert et al. (2017) compared in person focus groups vs interactive virtual focus groups using a video chat platform and found that virtual focus groups offered several advantages. The concluded that they were less expensive, provided faster data, increased diversity, reduced geographical distance limitations and reduced the demand on participants though they noted that virtual focus groups increased the probability of nonattendance. Menary et al's. (2021) research concurs with these findings whereas whilst Halliday et al. (2021) agree with the first four findings, they did not find an increase in nonattendance and instead found an increase of up to 50% compared to in person focus groups, which may be due to the improvements in technology.

Therefore, synchronous online focus groups were used to facilitate access to a wider cross section of the RP and to maximise attendance (Rezabeck 2000; Lidjadi and van Schalkwyk 2015). Bournemouth University has campuses in several locations in Bournemouth and the surrounding areas as well as one campus in Portsmouth. The focus groups were planned to be online as a way to include the RPs in these mixed locations and mixed healthcare professions with more ease. The Covid-19 pandemic lockdowns then made these online focus groups a necessity as well as affecting healthcare students' availability in different ways. For a period of time during the pandemic RPs were only expected to work in clinical practice if they were in their final year of education (Swift et al. 2020) and therefore the RPs for part of this research were comprised of mostly first- and second-year healthcare students from physiotherapy, paramedics, midwifery and nursing professions. Zoom was chosen as the platform for these focus groups because the university was using it for online face to face (F2F) teaching. The meeting can be locked so that participants can only join with log in details and a waiting room can be enabled in order for the host to confirm the name of the person in the waiting room is an expected one who has signed their consent form prior to joining. Zoom has been used successfully for focus groups and has been recommended for this use for several of the reasons mentioned above (Marques et al. 2021).

Finally, because of my experience as a registered midwife and registered midwifery teacher, I know that healthcare professionals work autonomously as part of a

collaborative collective and that it is important to support students from early on in their training with learning how to:

1. Develop the confidence to advocate for people they provide clinical care for
2. Work autonomously whilst being mindful of the needs of the wider team around them

I would argue that participating in focus groups to share individual perceptions of shared experiences, which may vary dependant on individual and professional perception of the scenario, can be a valuable experience of the above two points.

4.5.5 Focus group size, formation and process

Focus groups mimic the climate of multidisciplinary collaboration to stimulate dynamic discussion in order to review care and achieve best health outcomes. Focus groups also have a paradigmatic fit with group-based learning utilised during theory sessions where students collaborate on projects and peer review each other while learning clinical skills (Basch 1987, Stalmijer et al. 2014).

Researchers vary in their suggestions for the best size for focus groups but the general consensus is that there should be 2 – 12 participants and last 30 - 90 minutes (Smithson 2010; George 2023; Fleetwood 2023). In order to ensure the focus group size was optimal for this research an ideal participant number of a minimum of four and a maximum of nine participants per group was recommended in the booking information available to the RPs for each date and time. This number was decided after taking into consideration the need to try and avoid making individuals in smaller groups feel pressured to speak at length. Of equal importance was making sure there would be enough time for everyone to be fully heard as part of a larger group's rich discussion within the 60 minutes allocated to each focus group (Kitzinger and Barbour 1999, Crabtree and Miller 1999, Barbour 2005, Bloor et al. 2001). This method of self-allocation resulted in the focus groups having a varying number of participants in each; the smallest group had three RPs and the biggest group had nine RPs and overall there were a total of 31 RPs.

The focus groups were conducted between September and November 2020. RPs were able to choose from a variety of dates and times to participate in the maximum 60-minute-long synchronous online focus groups by using a Doodle Poll to make their selection and were also able to see who else would be participating which is argued to be of importance for enhancing participation during the focus group (Parker and Tritter 2006). In this way they were able to self-select a session they would feel most comfortable being present in so they could have their voice heard as part of the larger

collective of RPs. This was responsible for the variance in size of focus groups. The beginning of each focus group included introductions and thanks for participating in this research. The RPs were reminded that the focus group would be recorded to enable transcription, then anonymised at the point of transcription, that the thesis would likely be published and that anonymised research findings would be used in publications. The RPs as a group were then prompted to begin the discussion of their experience of the VRLE. During the focus groups the more confident individuals occasionally began to dominate the group discussion, but this was moderated though use of the additional questions which opened up the forum and encourage the others who were less confident to bring their opinions into the discussion (Stalmeijer et al. 2014, Forister and Blessing 2020).

Main question:
What was your experience of using the VRLE?

If further prompting was required, then the RPs were asked:
What did you enjoy about using the VRLE?
What do you feel could have made your experience better?
What do you feel you were able to learn while using the VRLE?
What impact do you feel the VRLE use had on your clinical practice?

4.5.6 Data analysis and synthesis method
Phenomenographical analysis was initially chosen as the approach for this research as it is commonly used by phenomenographers (Marton 1992, Walsh 2000). Although there are variations in the way the data is managed (Akerlind 2005; Sandberg 2017; Straub 2021), with others arguing that there is no agreed way of analysis of phenomenographical data (Ashworth and Lucas 2000; Heyman 2015; Han and Ellis 2019), there is a general consensus on the need for collaboration during the analysis in order to ensure research rigour and validity of findings (Akerlind 2012; Larsson and Holmstrom 2009; Daly 2009). However, it has to be acknowledged that this has been somewhat marginalised by others who say the emphasis should be on whether the research has added findings which ultimately are of benefit to pedagogy in higher education (Entwhistle 1997; Tight 2016b). Consideration of the impact of debate above on the decision for type of analysis was disrupted due to the fact that analysis of the data for this research took place during the Covid – 19 pandemic when staff shortages were at an irreducible minimum and sourcing data analysis collaborators was not feasible.

Therefore, another method of analysis able to be successfully used with phenomenographical research had to be chosen. It was key that the chosen form of analysis would support determining the significance of the RPs collective experience of

the action (Thomas and Harden 2008; Sandelowski et al. 2012; Petticrew et al. 2013). Additionally, the analytic approach chosen needed to prevent researcher bias as collaboration on the data analysis was not possible for this research (Smyth et al. 2020). Thematic analysis has been used for analysis by phenomenographers for a number of studies, either as a singular analysis approach (Sandy et al. 2014; Brown 2020; Dolette 2021) or as a combined analysis approach (Hawkins et al. 2017; Smyth et al. 2020; Abid 2021; Guglietti 2022). Interestingly, some researchers who used the combined thematic analysis and phenomenographical analysis approach declared that the findings of each approach mirrored the other (Heyman et al. 2015) or that the findings were remarkably similar (Magana et al. 2019).

Thematic analysis is described as a flexible approach which is widely used for interpreting healthcare research data (Boyatzis 1998; Gibb and Hundley 2007; Larsson and Holmström 2007; Green and Thorogood 2018). Researchers argue that thematic analysis allows the researcher to develop nuanced findings from the inductive analysis (Hsiu and Shannon 2005; Renz et al. 2018; Kleinheksel et al. 2020) and a way to bridge or translate the findings of qualitative and quantitative research (Forister and Blessing 2020). Braun and Clarke (2014) suggested that thematic analysis allows for researcher's analytical autonomy. In order to minimise the risk of profession bias (Daly 2009) the VRLE were storyboarded to be deliberately profession generic so that a variety of healthcare disciplines could be RPs rather than being limited to recruitment from students of the same profession as mine.

Data collected by mixed methods presents a wealth of information to analyse and reflect upon. The more detailed open text comments shared in the quantitative data collection has been combined with the quantitative data for analysis. O'Cathain and Thomas (2004) question whether data collected via an open text box option is potentially in a grey area of being neither directly quantitative nor qualitative. However, they do suggest it could also be considered unethical to avoid analysing this data despite the lack of clarity over the type of data it is. It has also been suggested that qualitatively analysing open text from quantitative data adds value by clarifying interpretations and as a result deepening understanding (Martinez et al. 2003; Harland and Holey 2011; Fogarty and Ramjan 2016).

Thematic synthesis will be used in Chapter Eight as a tool to consider the overall resultant pattern from the analysis of the quantitative and qualitative data (Thomas and Harden 2008; Sandelowski et al. 2012; Petticrew et al. 2013) and next steps. The combination of these will work to facilitate a deeper understanding of the impact on this

are of healthcare education and consider what needs to happen in order to move forward. By capturing an overview of how VRLE is experienced by the RPs as a group rather than individuals, followed by organising the data into patterns from which latent themes can be developed, then considering the overall impact using thematic synthesis a deeper understanding of the collective impact of this area of education can be established (Javadi and Zare 2016).

To undertake thematic analysis, which Braun and Clarke (2019) define as theoretically flexible, a reflexive approach to coding was used in order to support conceptualisation and to allow themes to emerge.

4.5.7 Reflexive and reflective coding

As discussed above, the decision was made to include qualitative data gathered from the open text feedback from the quantitative data collection, the three RPs who chose to provide written feedback, as well as transcripts of the eight focus group recordings. The focus groups were transcribed into text by listening to the recordings and assigning initials to individuals as they spoke. These were subsequently read numerous times in order to generate codes. Being mindful of the warning from other researchers of the need to prevent analytical bias when using thematic analysis as a phenomenographer (Ashworth and Lucas 1998), the qualitative data was read through as one document rather than divided into individual focus group data collections. Frequent breaks were taken while reading the transcripts (Ackerlind et al. 2014) including a longer break when this research project was paused due to the pressures from Covid -19 pandemic on staffing levels, which necessitated a break so that professional work could be prioritised over scholarly work.

Working within the 16 steps of coding in the checklist described by Braun et al. (2016), themes and subthemes developed. This checklist in its original form is linear and presented in ascending numerical order. However, after reflection of what was required in order to code and generate iterative themes, the checklist was adapted in order to more accurately portray the process as it was used for this research project's process with the integrated synthesis of data for this research (Figure 7). These themes were then used as the narrative for analysis in Chapter Seven.
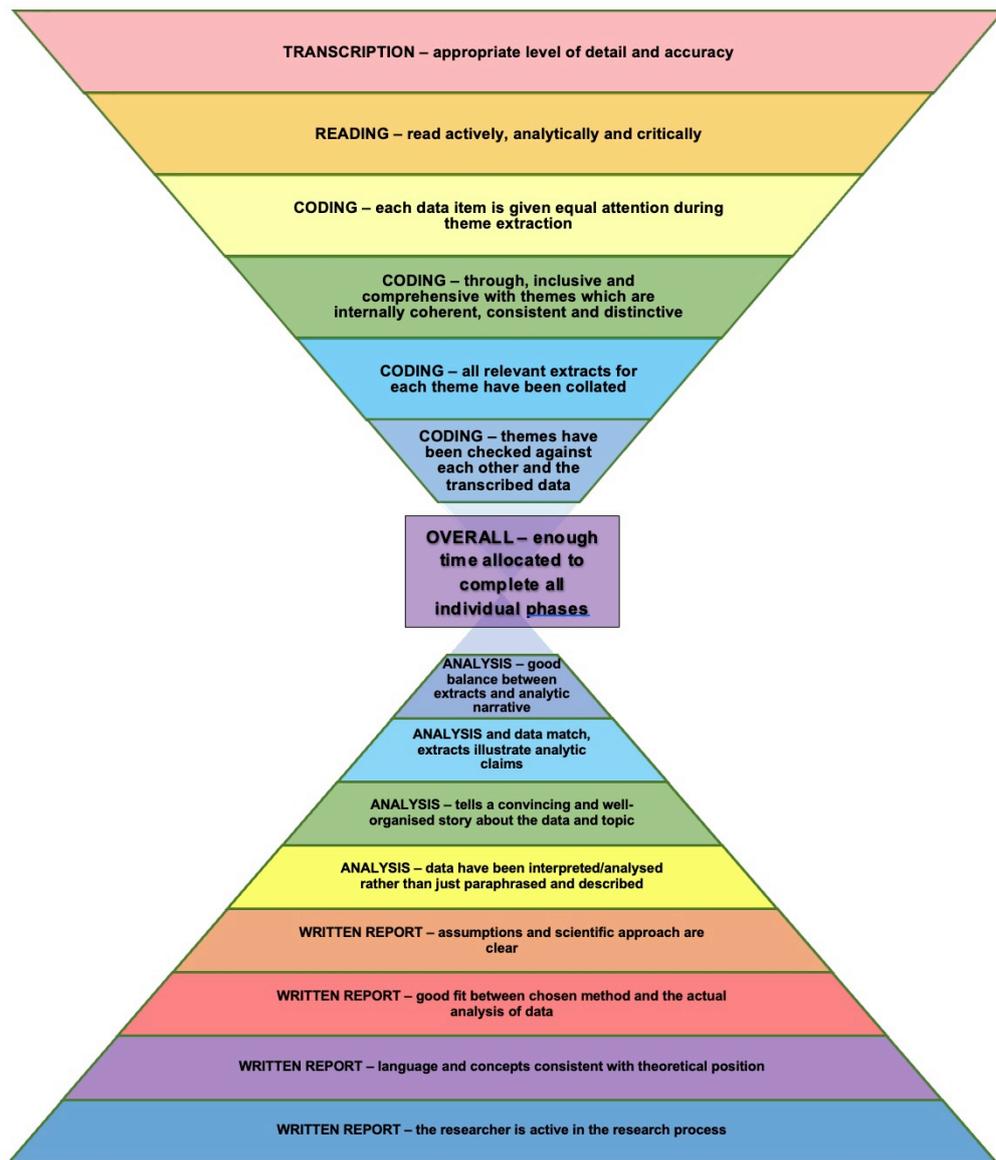
Figure 7 - Author's own iteration of Braun et al.'s (2016) checklist.

During the coding process I was mindful of Darlington and Scott's (2002) urging to remain diligent so as to maintain a locus of focus when coding, lest unforeseen relationships between data are missed. They state that whilst lists are helpful to open up the analytical possibilities of the research, they can also cause the researcher to lose focus. Therefore, they recommend that the themes should come from the research purpose and that the research questions themselves should have been focussed in such a way as to enable this data to be collected.

By typing directly onto the transcripts' word document without use of computer assisted data analysis software, codes began to emerge. When the transcripts were combined with the other qualitative data provided through open text feedback and written

feedback the codes multiplied with each reading of the qualitative data. During this process, notes were made on an emergent coding frame running alongside the data. This allowed for patterns in the data to be noted on review of the organically generated abstract and exploratory codes (Darlington and Scott 2002; Kara 2012; Braun et al. 2016).

The codes were noted to be quite changeable during the first four points of the coding section of the checklist (fig 5 above). In his paper on linguistics Barbieri (2020) suggests this is because we need to give meaning to the codes we create through interpretation of the information we receive. Therefore, it can be argued that change while interpreting the data can be expected and indeed welcomed as part of the robust analytic process (Elliott 2018; Linneberg and Korsgaard 2019).

Frequent breaks of varying lengths were taken to facilitate open-mindedness due to the lack of collaboration during this process as discussed in section 4.5.6 and 4.5.7 (Ackerlind 2012). Up to this point the process was not linear and involved going back and forth over the RP feedback to consider meanings whether whole or in part and, by doing so, continually developing and refining the patterns (DeSantis and Ugarriza 2000; Holloway and Todres 2003; Braun et al. 2016). This was taken one step further by including reflection, which is a key component of the gold standard of healthcare and one of the expectations from student and qualified physiotherapists, paramedics, nurses and midwives (Health and Care Professions Council [HCPC] 2021; NMC 2023b). It has been suggested that reflection is necessary in order to be able to facilitate empathetic healthcare and as result should be included in healthcare education and these points will be discussed during the analysis in Chapter Seven (Dohrenwend 2018). Therefore, reflection is an important part of the coding process in order to ensure that the resultant themes are reflexive (Braun and Clarke 2019; Artioli et al. 2021).

Next, these codes were assigned individual colours and considered in relation to frequency of appearance (table 7). Then these were grouped together to better support consideration from a phenomenographical lens. The groupings with the most repetitions of individual colour were retained and the remainder discarded.

	cos there were like technical issues so it would be good to ideally have it in the classroom but if you're going to practice this at home it would be good to ideally have it in the VRLE as well just to help us practice. if we hadn't pressed gut instinct or something after a while maybe if it came up like something in the corner to say we should have picked up on that…things we might have missed…it didn't actually tell us if we've missed anything	Clinical practice opps Gut instinct and alarms bells Feedback too generic / not individualised Technical issues New concept
33	L: I thought it was a really memorable way to learn. I mean that I find I can remember clearly a lot of what we learnt through the VRLE I think because it's going into a space and making decisions like that that I find it easier to remember than maybe other information that you're given over safeguarding. Perhaps because it just more mimics a real situation more	Good tool Realistic Clinical practice opps Engaging
34	C: Absolutely. Because I always think safeguarding is a really hard thing to learn how to do. You can learn the theory of safeguarding but actually to go in and be making decisions like that is a really good way to learn. I really liked it.	Clinical practice opps Bridge t/p gap Different way of learning Good tool
35	V: And I think also like even in just the first	

Table 7 - Colour coding.

The combination of these code dyads and triads gave rise to the overarching thematic component. These semantic codes formed the main themes with the resultant latent themes as the sub themes. This process is supported by Clarke and Braun (2019) who recommend using themes in a way which encompasses the diversity of the data's meaningfulness. From this continued immersion in the qualitative research data the codes began to develop into meaningful patterns from which preliminary subthemes and themes emerged (Aronson 1994).

4.5.8 Emergent subthemes and themes
The reflexive process during coding developed into patterns and from these 12 subthemes were noted:

- Safety and boundaries

- Holistic care

- Trusting in bodily responses to stimuli

- Difference in experience depending on familiarity with concept

- Familiarisation with new skills

- Improved clinical practice knowledge

- Scope of practice / professional identity

- Increased practice opportunities

- Battery and capacity issues

- Connectivity and security
- Navigation in VRLE
- Clarity (lack of) information

These subthemes were then grouped under preliminary themes:
1. RPs emotional connection and engagement with the characters
2. Identification with the role they played within the VRLE
3. Experiencing clinical intuition
4. Impact of technological functionality

Table 8 below summarises the differences between preliminary and final themes and subthemes.

Preliminary themes	Preliminary subthemes	Final themes	Final subthemes
RPs emotional connection and engagement with the characters	Holistic care Increased practice opportunities	Consideration of individual characters within the VRLE as a whole person	Holistic care Safe boundary building
Identification with the role they played within the VRLE	Familiarisation with new skills Improved clinical practice knowledge Difference in experience depending on familiarity with concept Scope of practice / professional identity	Identification with role / professional identity	Familiarisation with skills required for challenging conversation and problem solving Increased practice opportunities to bridge the theory-practice gap Increased knowledge of how to conduct clinical practice though safe fails Educational value
Experiencing clinical intuition	Safety and boundaries Trusting in bodily responses to stimuli	Physiological manifestation of clinical intuition	Trust your guts Sense of unease New concept
Impact of technological functionality	Battery and capacity issues Connectivity and security Navigation in VRLE Clarity (lack of) information	Functionality	Battery and storage capacity Connectivity and firewalls Navigation challenges Clarity of information

Table 8 - Summary of preliminary and final themes and subthemes.

In Chapter Seven these themes and subthemes will be presented in detail, then analysed and discussed in relation to extracts from the RPs feedback with reference to

existing literature (Braun and Clarke 2006). Chapter Eight will consider the insights produced when quantitative and qualitative findings were combined with each other, the coherence of these and finally recommendations for future research will be proposed (Holloway and Todres 2003; Krippendorff 2004; Petticrew et al. 2013).

4.6 Ethics, Access and Recruitment

4.6.1 Dimensions of research ethics

Thorough ethical consideration is crucial in order to adequately protect research participants. The 2014 Care Act focuses on ensuring maintenance of the wellbeing including those participating in education and training. The Disclosure and Barring Service ([DBS] GOV.UK 2012) is part of this Act and works to prevent unsuitable persons working with vulnerable groups and which all lecturers must have a current DBS certificate (should be renewed every three years) in order to teach and advise students. The BU Ethics Committee carries on from the work done through the DBS check and thoroughly examines the prospective researcher's plan. Hammersley et al. (2012) offer assurance that educational research which does not intend to cause a major action in participants' lives is unlikely to generate serious ethical issues compared to medical research with physiological action. However, all researchers have an obligation to ensure that research is ethically sound and the ethics review process which sanctions proposed research projects within universities supports researchers to do this. The ethics committee review research proposals to ensure research projects have demonstrated consideration of ethics in four main areas: preventing harm to participants, ensuring informed consent, reducing invasion of privacy and whether deception is involved (Diener and Crandall 1978, Doyle and Buckley 2017).

Guillemin et al. (2004) propose that there are two dimensions to research ethics. The first dimension is procedural where the researcher seeks ethics committee approval. A research ethics checklist (Ethics ID 23182) was submitted to the BU Ethics Panel on 5th November 2018 and my action research concept testing (phase zero, Appendix 5) was approved subject to amendments. These amendments were subsequently approved by the Panel. The concept test VRLE was used to ensure functionality of sourcing and recruiting participants, and the research methodology and methods design in respect of gathering and analysing data. An amendment to the concept testing ethics application was requested in order to use the previously submitted checklist for the full research project for this doctoral thesis because the pilot research had validated the research methodology and methods with only minor amendments required to add robustness to the process. This amendment was approved by the Research Ethics Panel Chair on November 1st 2019.

Guillemin et al.'s (2004) second dimension relates to the ethical issues that may arise whilst conducting the research such as the journey to discovering the most appropriate way to build trust with research participants or ethical dilemmas related to arbitrary safeguarding disclosure. The latter is particularly pertinent to this research because the VRLE used have been created as a safeguarding scenario. I am a registered midwifery lecturer and registered public health practitioner and therefore would argue that I am doubly ethically bound by the professional standards of which ethics is threaded throughout both professions (UKPHR 2018; NMC 2023b). Therefore I am able to appropriately support or signpost any RPs who might experience distress as a result of the VRLE content. Conversely it is important to be mindful that the research participants for this project could be considered as vulnerable persons from the outset. This is due to the fact that they are either students at the university where I am employed or that they are healthcare students participating in research undertaken by a person whom they may view as being able to influence their lecturers' perceptions of them as students as well as having easy F2F and email access to the students.

Resnik (2011) states that Ethics Committee Panels and subsequent research Supervisors are expecting to see that the research plan provided will be adhered to, that the research will be undertaken with integrity, whilst maintaining respect for legality and ultimately striving towards responsible publication. Resnik (2011) argue that codes and policies are important for decision making in procedural and practice-based research ethics and suggest that they can be too succinct to offer support for every ethical situation. Therefore, they recommend that the researcher should simply apply ethical rules to help resolve issues. Furthermore, Hammersley et al. (2012) warns that when a researcher is conducting research whilst working a dual role, for example practitioner research such is the case with my research where I am looking at education of future health professionals, this may affect my judgement about what is ethical, and I may have to prioritise more for one role than the other.

Conflict between my two roles is unlikely to arise whilst conducting my research because I am conducting research into education that will benefit both the midwifery profession and my role healthcare student teacher. As discussed earlier, action research is a suitable framework for insider research into healthcare education innovation (Robson and McCartan 2016; Verma 2021). Interestingly Faden et al. (2013) argue that there should not be a separation between traditional research ethics and clinical ethics but caution that research in healthcare is more than simply a learning activity. Therefore, it should not be undertaken unless the researcher has

every intention of improving clinical practice or the healthcare system. This consideration merges with the action research principles discussed earlier, including the challenges that this paradigm presents in respect of inherent resistance to change within everyday practice.

4.6.2 Ethical consideration during research planning and design

Ethics are moral codes or principals which are in place to avoid the causation of harm and the following bioethical principles have been created for protecting healthcare RPs (International Council of Nurses [ICN] 2006):

Beneficence

The right to protection from physical and psychological damage which is also known more simply as the act of being kind is as important for RPs as it is for anyone taking part in an episode of healthcare.

Confidentiality

Respecting the information provided by RPs and protecting them as individuals unless disclosed information indicates that they make be at risk of harm. If this is the case then a conversation needs to take place with the RP in which the options available to the RP are discussed. A breach of confidentiality should be avoided unless there is no other option to protect the RP and if this is the case then if should be done with the RP's permission whenever possible.

Veracity and fidelity

Establishing and maintaining a truthful and trusting relationship can be challenging with students the researcher knows (Guillemin 2018). As will be discussed this can be overcome though use of anonymous feedback and named persons for the RPs to approach should they feel unable to be fully open about their feedback with the researcher.

Justice

The right to fair treatment and privacy as above is key in ensuring that the RPs are able to be transparent about the impact of their research experience. RPs need to be assured that this will take place.

Respect for dignity

The right to independence and to be kept informed of findings, actions taken as a result, as well as recognising their anonymous contribution to the furtherment / betterment of educational knowledge.

As a phenomenographical action researcher and healthcare professional I have an ethical duty to adhere to these bioethics and thereby ensure that every step has been taken to avoid the risk of RPs coming to harm as a result of their direct involvement with this research (Gostin 1991; ICN 2006; Drumwright 2015). Therefore, the healthcare students were invited to join the research as an individual part of their whole year cohort, in order to reduce the possibility of perceived pressure on any individual to participate. Additionally, they were informed that by participating they would be able to contribute to betterment of the learning experience for future students but that there would be no other incentive offered in return for participating in this research. There are varying views on whether incentive offering is of value as a means to increase response rates from those in support of this measure (Young et al. 2015; Robb et al. 2017; Guastaferro et al. 2022), those who say it offers no increase in responses or other benefits (Young et al. 2019; Sammut et al. 2021) and those who argue that financial incentives may have negative ethical implications, particularly when RPs are recruited from the same faculty or professional discipline (Ferguson et al. 2004).

4.6.3 The research participants and their recruitment
The research participants

The RPs that took part in the concept testing (phase zero, Appendix 5) were all midwifery students. There were 20 pre-action contributors and 10 post-action contributors who provided quantitative data via online questionnaires (Appendix 8), five who provided qualitative data in post-action focus groups (Appendix 9) and two who contributed written feedback (Appendix 9) instead of attending the focus groups. These were quite small numbers but useful to give some indication as to whether VRLE would be worthwhile exploring as a potential pedagogical action (Chapter Five, section 5.6.6).

The RPs that took part in this main research (phase one, Appendix 5) were drawn from midwifery, nursing, paramedic and physiotherapy healthcare disciplines across the three years of their healthcare programmes. There were 311 RPs who contributed to the quantitative data collected before VRLE use and 253 post-action. These were made up of 39 paramedic students, 22 physiotherapy students, 27 nursing students, 6 public health students and 217 midwifery students. There were 31 RPs who chose to participate in the focus groups for phase one (11 paramedic students, 7 physio students, 16 midwifery students). Three RPs (all midwifery students) chose not to participate in the focus groups but wished to contribute written feedback about their experience and were invited to do so. Finally, there were the RPs who contributed

qualitative feedback via the open text box option in the online questionnaires used to collect quantitative data.

Recruitment

Geographical convenience sampling (Trotter 2012) was used to recruit participants from all three years of the cohorts from four healthcare disciplines from an education institution based in England. The recruitment aimed to establish RPs from healthcare students enrolled in at least two healthcare disciplines. Each cohort was spoken to about the research when they were present in university for in class sessions. During the information session and on the information sheets, the students were assured that their responses to the pre-action and post-action surveys will be displayed anonymously to the researcher, that the focus groups will be anonymised during transcription at which time the video files will then be deleted. The potential RPs were given participant information (PI) sheets (Appendix 10) which included their right to decline to participate or to stop participating at any point if they chose to do so. They were asked to sign a participant agreement (PA) form if they decided to participate (Appendix 10). Confirmation of their consent was also gained before the focus groups proceeded.

The participants were recruited from Bournemouth University with the help of my teaching colleagues in healthcare programmes. I wrote the VRLE content to be profession generic and topic specific so that clinical skills can be practiced by healthcare students from a wider variety of disciplines. Students who are not studying healthcare related courses were excluded from recruitment. I had intended to recruit a minimum of 20 RP from each of the cohorts through convenience sampling, but the positive response led to 311 healthcare students offering to contribute and being enrolled as RPs. Farrokhi (2012) warns a convenience sampling method should not be used if wishing to compare two groups. As I was not looking to control variables but instead searching for commonalities within the RP as a whole through both the quantitative and the qualitative data convenience sampling was appropriate. Marshall (1996) warns that convenience sampling lacks intellectual credibility and may result in poor quality data whilst Etikan et al. (2015) disagree stating that convenience sampling is an inexpensive process that is easy to use. However, convenience sampling was suitable for my research as the sample was drawn from a convenience of healthcare students. Therefore, it might be more appropriate to refer to my participant recruitment method as judgement sampling from key informants (Marshall 1996).

Selection was decided by the proposed RPs' willingness to participate in all aspects of this research: the pre-action online questionnaire, the post-action online questionnaire and a virtual focus group chosen by the individual from a variety of available dates and times. Students who would graduate before the research was complete and those who could not commit to contributing to both the quantitative and qualitative components of the data collection were excluded.

4.6.4 Ethical considerations during recruitment

The student cohorts were asked to return the PA forms by a particular date and a reminder was sent via university email one week before this date along with a request to the student year reps to remind the cohorts of this date on their social media forums two days before the consent forms were due in. Potential RPs were given the option to hand their consent to their Personal Tutor (PT) who thereby acted as a gatekeeper between the student and myself to reduce any perceived pressure the students may have felt to take part in this research. The RP were also asked to confirm they were given adequate information to support their understanding of the research and what was expected of them as RPs as part of their informed consent to participate. Informed consent is an important part of research and the RP's decision to participate must be voluntary, that they are aware they can withdraw from participation at any time and that this is evident in the research participant recruitment process, clearly documented and auditable (Speziale et al. 2011).

4.6.5 Ethical considerations during use of VRLE

Consideration also needs to be given to the potential risk of harm being caused to participants during use of the VRLE. Harm could be caused if they choose to experience the VRLE wearing a fully immersive VR headset. Risk of nausea and disorientation associated with low-cost headsets has been noted by previous researchers, particularly with prolonged use (Herman et al 2018; Perla et al. 2018; Williams et al. 2018). The potential health and safety risks that can be associated with this were discussed with the potential RP, including role play demonstration of these to reinforce the message. Additionally, the participants were reminded that they can access and experience the VRLE through their computers, laptops or mobile handheld devices without donning headsets. As the VRLE have a focal topic of safeguarding, the RPs were made aware of support available to them should they feel distressed or otherwise impacted by the VRLE content. Finally, due care was taken to ensure that comprehensive information about the expectations of the prospective participants was provided in order to obtain robust and truly informed consent and thereby reduce risk of confusion or misinformation (Lynöe et al. 1991; Corrigan 2003; Guillemin et al. 2004; Miller et al. 2012).

Ethical deliberation has been undertaken, with mitigation of risk being performed by the Research Ethics Panel and further endorsed through the conceptualisation (phase zero). Thusly, it has been demonstrated that ethical considerations were rigorously applied at each stage of the research from planning and design to recruitment of participants and safeguarding during use of the VRLE.

4.6.6 Ethical considerations for data analysis and discussion

It was a challenge to decide which quotes to include / exclude in the discussion because every individual RPs' voice deserves to be heard (Marsh 2019). This is difficult when the data has been viewed through a phenomenographical lens as the representative quote choices are required to be the collective voice of the RPs (Sin 2010). It is important that the quotes chosen not only represent the majority view but are also evocative and expressive of the themes or subthemes to support transparency and rigor of research findings (Ekstrom et al. 2019; Eldh et al. 2020). Therefore, a return to coding colours aided identification of quotes which illustrated the majority opinion for meaningfulness related to the theme or subtheme being discussed (Frank et al. 2009; Chang et al. 2023).

Some of the data related to safeguarding experiences the RPs had in practice which cannot be shared for confidentiality reasons. Some of the quotes related to requests from the RPs for additions to the VRLE portfolio but were not representative of the collective experience. Instead, these will be discussed in the in Chapter Eight as they are of value in shaping recommendations for next steps.

It was a delicate balance to view the data in a phenomenographical way in order to present the data which prioritises the collective experience of the action, without generalising, marginalising and under-interpreting the RPs contributions which did not directly relate to the research questions (Sandelowski and Barroso 2002, Taylor-Powell and Renner 2003; Bowden and Green 2010). Therefore, the quotes discussed in Chapters Six (quantitative) and Seven (qualitative) were chosen because of their substantive relationship to the research questions (Ballesteros and Mata-Benito 2018). Quotes which reflected similar views were excluded but are available for reading in Appendix 7.

4.7 Chapter summary

The chosen methodologies and data collection approaches are designed to explore the impact of learning clinical theory and experiencing clinical practice opportunities within VRLE. Ethical deliberation has been undertaken, with mitigation of risk being performed by the Research Ethics Panel and further endorsed through the concept observation (phase zero). During analysis the key focus will be on the collective data from the RPs' autonomous experiences during use of the VRLE. Making links between quantitative and qualitative research data will make allowances for the fluidity in perception of the RPs' experience while learning within VRLE that may naturally arise during this time continuum.

Chapter Five: Creating and testing the Virtual Reality Learning Environments (VRLE)

"The virtual object is different from the nonvirtual one, but both are equally real."
(Chalmers, p.14)

5.1 Introduction

This chapter focusses on the practicalities of the planning of the design as well as the act of writing and creation of the safeguarding VRLE for this doctoral research project. As discussed in Chapter Four, these VRLE are categorised as phase one and were used for the action research for this doctoral project. Two safeguarding families VRLE were created for this research after the concept testing of the urinalysis VRLE prototype was undertaken. The VRLE scenarios for the concept testing prototype (phase zero – prior to this research) and the safeguarding VRLE (phase one – this research) are profession generic and topic specific to allow for flexible learning dependant on the healthcare discipline the RP is studying.

The VRLE scenario content was created with the intent of offering flexibility in order to provide learning at the level of study the VRLE user requires, from first year healthcare student to the continuous professional development (CPD) of the already qualified healthcare professional. The VRLE artefacts were built by Daden Ltd. who are a specialist VR education company who develop educational VR, which at the time of this research, was hosted on their TS platform.

This chapter provides detail on the design of the VRLE, the avatars (sections 5.2.1 and 5.2.2), the value of storyboarding (section 5.6.2) and using visual aids for communicating complex healthcare education requirements to people with no healthcare experience (section 5.6.4). Concept testing the prototype (phase zero, Appendix 5) is also discussed. Although this was done prior to planning and actioning the VRLE for this doctoral research project (phase one, Appendix 5), phase zero observation and reflection is the catalyst for the inclusion of the unique holistic care elements of the VRLE used for this research. Phase zero also provided opportunities to test and make changes to the data collection instruments before use for this research (section 5.6.6).

5.2 Inside and outside the VRLE

5.2.1 VRLE design
The VRLE for this research were designed using a blend of Bybee et al.'s (2006) 5E general model of learning in traditional reality (Table 9).

Engagement	Supporting students to make connections between what they know and can do which will guide their thinking towards the learning outcomes of the activity. This is key to develop deeper learning and confidence in healthcare skills.
Exploration	Exploring and engaging with new experiences under guidance. This should include making use of prior knowledge linked to the activity.
Explanation	This offers students the opportunity to show their contextual understanding and progress in the activity.
Elaboration	This stage supports students to make informed, impactful, skill-based decisions to address problems and move the activity forward based on feedback about their performance.
Evaluation	Students should reflect on the effectiveness of the learning activity, their performance within this and consider how to integrate their knowledge gains.

Table 9 - Bybee et al.'s (2006) 5E model of learning.

This was overlayed with De Freitas's (2010) Four-Dimensional Framework (Table 10) to add context to designing immersive learning which will be experienced in alternate reality. These tables outline the aspects of the models and address how they are relevant to the VRLE used for this research.

Dimension One - Learner specifics	Dimension Two - Pedagogy
Consideration of their profile and requirements for learning, including their role within the learning and technical competences, will help to reduce the gap between traditional and alternate reality learning transfer.	Use of associative models for task-based learning, as well as cognitive and social / situative models of learning will be of value to bring about desired learning outcomes.
Dimension Three - Representation	**Dimension Four - Context**
A good learning environment must strike a balance between usability and learning outcomes. Whilst realistic surroundings and interaction are important, if the fidelity is too high level, then it may distract from the learning. The sequence of events and feedback must be relevant to reality to lead to engagement with the scenario. Consideration needs to be given to the level of interactivity and immersion required to enhance engagement and motivation with the learning environment.	Environmental considerations need to be undertaken as whether they are formal or informal or both will impact on the outcomes. Consideration also needs to be given to the disciplinary context (for example in the case of this research project it is healthcare in general rather than a specific healthcare profession), where and how the learning can be accessed and if the resources are widely available.

Table 10 - De Freitas (2010) Four-Dimensional Framework.

5.2.2 Avatars
An avatar is an animated self-representation of the VRLE user which exists digitally in the VRLE (Klevjer 2022). The VRLE user is able to choose the body shape, skin tone,

hair colour, clothing, accessories and more, limited only by the availability offered by the virtual environment. For example, in the VRLE the users do not have an option to dress their avatar in everyday clothes and instead must choose clinical uniforms as their garments. The VRLE user's avatar is not available to them in other virtual environments. Avatars in the private access VRLE are not the same as the avatars available in the publicly accessible platforms of Virbela ™, Second Life ™ or the non-animated 'sticker' avatar representation of individuals available on Facebook ™. However, it would seem entirely plausible to suggest that this could be a natural progression of functionality relatively soon as we are making faster progress settling into the digital world as a side effect of the coronavirus pandemic lockdowns. In fact, many have established digital presences as a result of new ways of working, learning, sharing knowledge at conferences and working collaboratively in meetings (Pandey and Pal 2020; Procter 2021). As the avatars are a person's chosen representation, it makes sense to be able to access the one representation on all virtual platforms if the user wished to do so.

Figure 8 below shows a screenshot of my avatar taken inside the community clinic VRLE where students can practice a variety of clinical skills for urinalysis using avatar representations of themselves. This VRLE is the one which was used for the concept testing (phase zero, Appendix 5) of this research (section 5.6.6).

Figure 8 - Avatar representation in VRLE.

Figure 0 below shows screenshots of my avatar taken inside the SL platform on an area in the VW where I sometimes go for thinking time because it reminds me of the island that I grew up on and visiting this area in SL instils the same feeling of peace in me that I get when I go back home for a visit.

Figure 9 - Avatar representation in Second Life ™.

Figure 10 below shows a screenshot of my avatar taken inside Virbela ™ where I go for conferences and other learning sessions.

Figure 10 - Avatar representation in Virbela Open Campus™.

Figure 11 below shows a screenshot of my avatar sticker from Facebook which is the platform I use to connect with family and friends around the world. The avatar sticker below is also the one which I currently feel is the closest actual representation of myself in traditional reality.

Figure 11 - Avatar representation in Facebook ™

The difference between the three animated avatars and the nonanimated avatar 'sticker' represents the different uses of the platforms and the different personas I adopt within VR. One I use as a registered healthcare professional, one I use an everyday citizen to explore education and other possibilities, one I use as a conference delegate and one I use for social interaction with family and friends. My avatar representation helps students to recognise and respond to me as a familiar individual when teaching in a shared VR space. The avatar personas help me to quickly focus on the task I entered the VR platform for and to function appropriate to that task throughout my time there.

The fidelity of the avatars in the VRLE used for this research means they resemble characters from animated graphic novels and therefore takes the aforementioned research projects a step further. Figure 12 below shows how the avatar resembles a character in a comic but when motion is added to this within the VRLE it adds another dimension of realism to the overall learning experience. This has been evidenced as a physiological manifestation of emotional reactions reported by the RPs when the baby opens her eyes. At this point the RPs are faced with the possibility that they are having to deal with a safeguarding issue because of the redness in conjunctiva (the whites of the eyes) in this 14-day old baby is indicative of possible abusive head trauma (Harris and Stagner 2023). This physiological reaction by the RPs to baby Evie's visible

trauma, along with other aspects of the VRLE scenario that affected them in similar ways, is discussed in Chapter Seven.
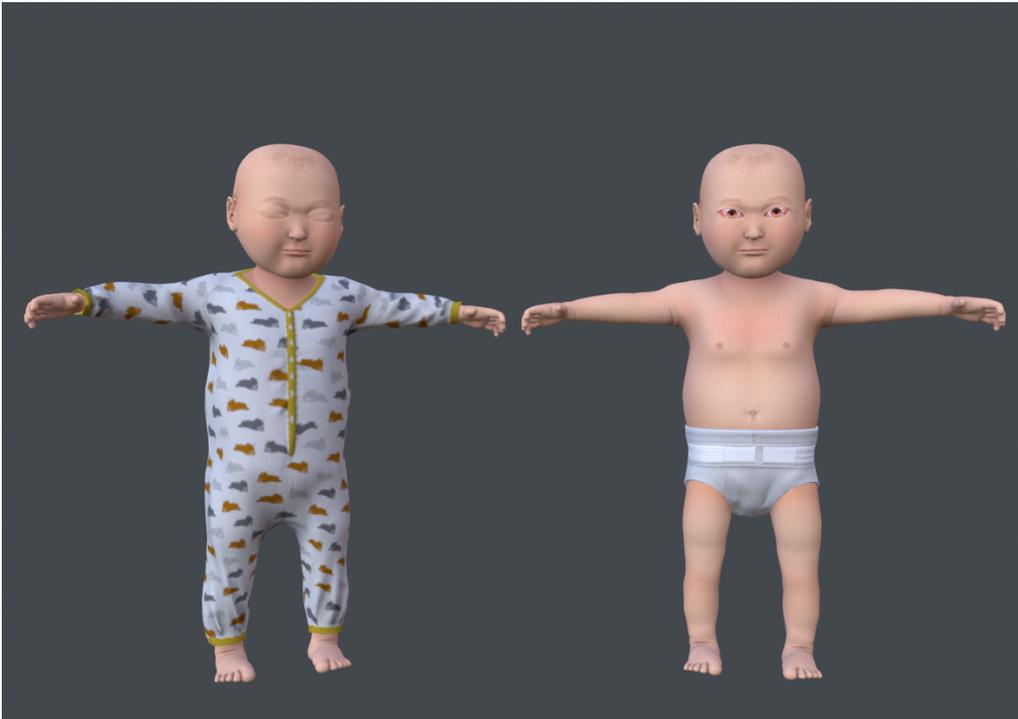
Figure 12 - Baby Evie being designed to have visible trauma in her conjunctiva.

The two VRLE built and used for this research offer the leaners space to immerse themselves as avatars in the environment of a virtual home, meet the family, listen to what they all have to say, see how they all behave towards the healthcare professional and each other, consider their living conditions, and then work with the family to implement appropriate safeguarding actions for individual family members. The actions required range from early help to urgent action including hospital admission transported by emergency ambulance. The VRLE users are able to walk around the family homes and talk to family members to determine what issues of significance there may be in relation to safeguarding various family members.

The VRLE challenge learners to use theory and clinical skills to identify problems and determine healthcare solutions targeted to mesh with their level of learning to date. Their clinical skills need to be put to use in order to obtain information from the often-reticent family members and make decisions about the urgency of the safeguarding needs, as well as which referral pathway to take. Additionally, the VRLEs' scenarios occasionally place the RP's avatar in a position where they may be at increased risk, such as when there is a member of the family between them and the door or other exit from the room.

Figure 13 below shows a screenshot taken inside the Melser family safeguarding VRLE. This family and their dwelling visually score high on multiple deprivation indexes which challenges users to look beyond the obvious to determine what level, if any, of safeguarding is required for members of this family.

Figure 13 Screenshot of Melser family home safeguarding VRLE.

The VRLE users also have to work hard to establish effective conversations with family members who are reluctant to disclose information, and who interact and coexist in ways which are not the expected norm. In addition, they are intermittently verbally aggressive to the avatar representing the healthcare student during the VRLE scenario. This offers an opportunity for the VRLE user to practice maintaining their professional behaviours whilst working through to a resolution of the conflict, ensuring suitable healthcare is offered and whilst maintaining their personal safety.

The other VRLE for safeguarding (Figure 14) allows users to enter a home of the Parvell family who despite their significantly more well-off socioeconomic status, nevertheless have needs related to safeguarding their safety and wellbeing.

Figure 14 - Screenshot of the Parvell family home safeguarding VRLE.

Members of the family are dismissive of the VRLE users' concerns over the health and safety of their children. The VRLE user must work out ways in which to convince the adults in the household that their concerns are valid and that increasingly urgent actions need to be taken. These scenarios mimic a range of situations that occur in relation to safeguarding families in everyday clinical practice.

During the concept testing (phase zero, Appendix 5) students practised accessing and using the VRLE on handheld mobile devices after being introduced to it in the classroom environment in order to find real time supported solutions for any access issues they might encounter (Cobbet and Snelgrove-Clarke 2016). The access issues and other aspects will be discussed in Chapters Six (quantitative) and Seven (qualitative). The students in class were accessing the same VRLE at the same time but asynchronously so they only saw their avatar in the VRLE on their own with the person needing care and were not able to see their classmates even though they were using the same VRLE at the same time. That option is controlled with a simple switch which can be manipulated by the teacher linked to the VRLE topic or the unit in which the VRLE topic is timetabled.

Healthcare students could also opt to access the VRLE through a university owned head mounted device (HMD). These particular HMD have a safety feature which allows a guardian boundary to be drawn in the virtual environment. If the HMD wearing user

steps outside of this boundary, then the person is immediately able to see the real-life environment through the headset instead of the virtual one.

As detailed above the VRLE can be experienced asynchronously by students as individuals on their own at a time and place of their choosing with the other avatars being moved through the scenario by the VRLE. They can also experience it synchronously with other students at the same time, with each taking on a role as part of group learning or revision.

Figure 15 below is a screenshot taken inside a hospital room within the VRLE which shows multiple avatars working together to synchronously resolve an increasingly urgent complex care condition.

Figure 15 - Representation of multiple avatars in a VRLE.

There was a lot of interest at the 2019 Further Education for Leadership Parliamentary symposium (Figure 16) during which the VRLE were showcased and experienced by delegates.

Figure 16 - VRLE being experienced during a symposium
(photo credit – Policy Connect).

> "Thank you so much for your contribution to the Further Education for
> Leadership symposium on Ed-Tech that our team organised yesterday in
> Parliament. The VR learning tools you brought were amazing and certainly
> could have helped me when I was a social worker many years ago and very
> much chime with the work the government is talking about when it comes to
> training the NHS work force."
> (Shaw, J. Chief Executive Policy Connect. Personal email 18th July 2019)

5.6 Writing and developing the VRLE content

5.6.1 Overview

In healthcare education scenarios are used to reinforce and add depth to session
content. They are also used to give the session content some realism so the student
can fully appreciate what the session means to them in the context of providing care in
the clinical environment. A VRLE begins with a link to a learning concept, much in the
same way as a written scenario does, but this in then layered with freedom to observe,
investigate, explore and role play as well as participate in multiple choice question,
answers and feedback sections in order to give the learning experience depth. So
rather than students having to act out the role in front of an audience of their peers and
session lecturer, they are able to immerse in, role play and learn from the experience
without a real-life audience observing them. The VRLE allows users to learn at their
own pace and to learn from making mistakes without negative impact on patients,

colleagues or NHS resources. Within the VRLE the students can learn asynchronously, or synchronously as a group or multidisciplinary collaborative in realistic simulations set either in a patient's home, a community clinic, or hospital. This served as the foundation on which to plan and begin creating content.

5.6.2 Communications and challenges thereof

Creating the content for VRLE is complex and time consuming but worthwhile given the immersive experience that can be built with comprehensive content to navigate from. The content must be written in a way which is not only clinically correct but also supports the technical developers who have no healthcare experience or knowledge to bring the content to (virtual) life. Unlike video or audio platforms where complex information can be communicated verbally the VRLE uses images and text-based information overlaid with a soundscape to add depth to the authenticity (Falconer 2017). This technique of translating scenarios into a format that can be efficaciously understood and utilised by technical developers is known as storyboarding (Brainksma and Thalen 2013; Sacks et al. 2013).

5.6.3 Storyboarding

The storyboard communicates how each element of the VRLE will function, scaffold, and link to become unique high fidelity learning environments, which will stimulate learners to engage with the situation and achieve skills transfer in the virtual environment (Pender 2014; Kim et al. 2017; Rennie 2020). Storyboarding is a way of writing content which gives it dimensions beyond that of the words on paper-based scenarios. This supports the technical developers when building the virtual environment for use by healthcare students. The storyboard needs to be written in a way which avoids the virtual scenario *telling* a learner information about a healthcare user so that they can work through the learning in order for it to be embedded at a deeper level (Hay 2007). The storyboard developed into immersive 2D or virtual 3D instead needs to *show* the learner this information with supporting assets (visuals and audios relevant to a virtual family, their home and contents).

In this way the healthcare students are supported to develop their holistic healthcare competences by deciphering and unpacking the information being provided to them through interaction with these virtual healthcare service users (Warburton 2003). This will allow them to progress through the VRLE to offer care choices, implement or perform the required healthcare and make forward care plans or onward referrals with appropriate signposting. This mimics real life healthcare experiences where healthcare users can be reluctant or unable to tell healthcare professionals everything they need to know, or when they do not understand what it is the healthcare professional wants to

know. Table 11 below is an example of the difference between telling and showing the necessary scenario information.

Telling (scenario)	Showing (storyboard)
Fiona Melser is unusually tired during this pregnancy. The house is a mess and her children are unsupervised at times they can be reasonably expected to be under direct supervision such as during the school day. Fiona is verbally aggressive, and resistant to engaging with or receiving advice from anyone she views as being in a position of authority which makes her seem defiant and non-compliant.	You: "Jake does seem to be very boisterous. When you were sleeping upstairs, he was jumping around and landing very close to the fire. I was worried for his safety at times." Fiona: "Oh here we go! You got your first dig in already. Call yourself a midwife but you don't even understand how tired being preggers makes you." You: "No dig intended. I just wanted to make you aware of Jake's behavior while he was down here on his own." Fiona: "Well he wasn't on his own was he, you were here and then Rosin came home and she also keeps an eye on him." You: "If he was at school you would be able to nap while the teacher kept an eye on him. It's not 3pm yet so Rosin must have left school early." Fiona: "The kids aren't the problem anyway. The problem is people keep poking their nose in our business – you, neighbors, school – it winds me right up. I got enough to deal with as it is."

Table 11 - Telling v/s showing the scenario when storyboarding information.

The storyboards also offer questions about the situation with multiple choice answers for the learner to consider. For every answer there is immediate feedback on whether the choice was the most suitable one. The feedback explains why, including filling in any suspected knowledge gaps. Further information is provided about the situation in order to guide and shape the learning available within the VRLE. These can be built in cascading multiple layers for added depth although this does incur an additional cost.

Figure 17 below is an example of a single layer example that relates to the storyboard section in Table 11 above (see Appendix 11 for excerpts from storyboards for each VRLE).
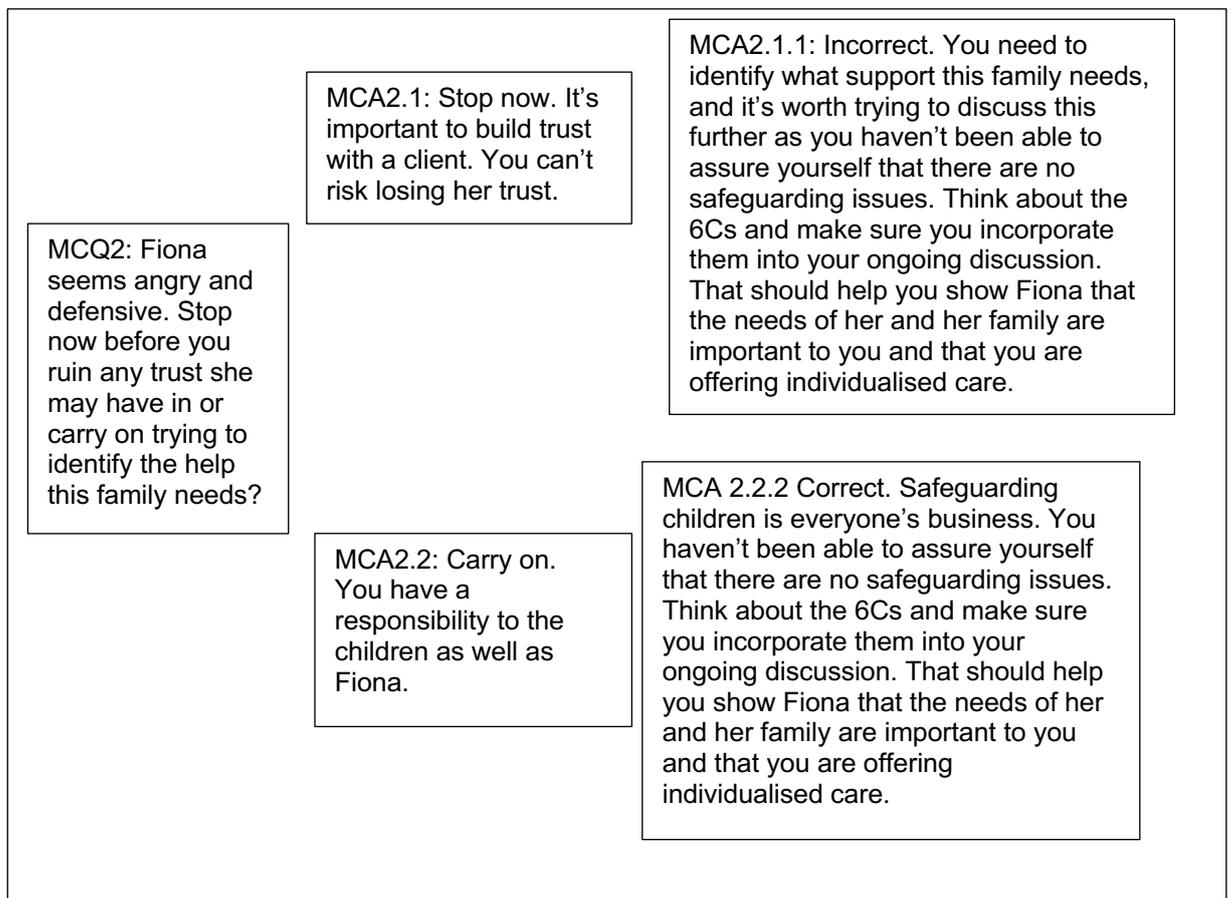
Figure 17 - Example of single layer multiple-choice questions and answers for the storyboard.

The storyboards for phase one were shared with a safeguarding specialist lead midwife who worked clinically at a large maternity hospital for her opinion on the suitability of the scenarios. She was able to confirm that the profession generic safeguarding scenarios an authentic fit with current safeguarding families' national guidelines (Gov.UK 2023) and regional policies and procedures before the scenarios were sent to the developers.

5.6.4 Visual aids
To add to the impact when healthcare students were immersed in the above family's home, it was key that they had a sense of the other issues the family was experiencing without it having to be shown through the dialogue or questions with multiple choice answers. To create an effective storyboard the written content needs to be reinforced with visual aids which can be assembled and presented using a commonly used

platform such as PowerPoint. This technique was used for creating the concept testing VRLE and for the safeguarding VRLE for the main research project.

Figure 18 below is an example of photos sent as visual aids (left side) which the developers translated digitally into the representation shown in the screenshot taken from the concept testing urinalysis VRLE (right side).
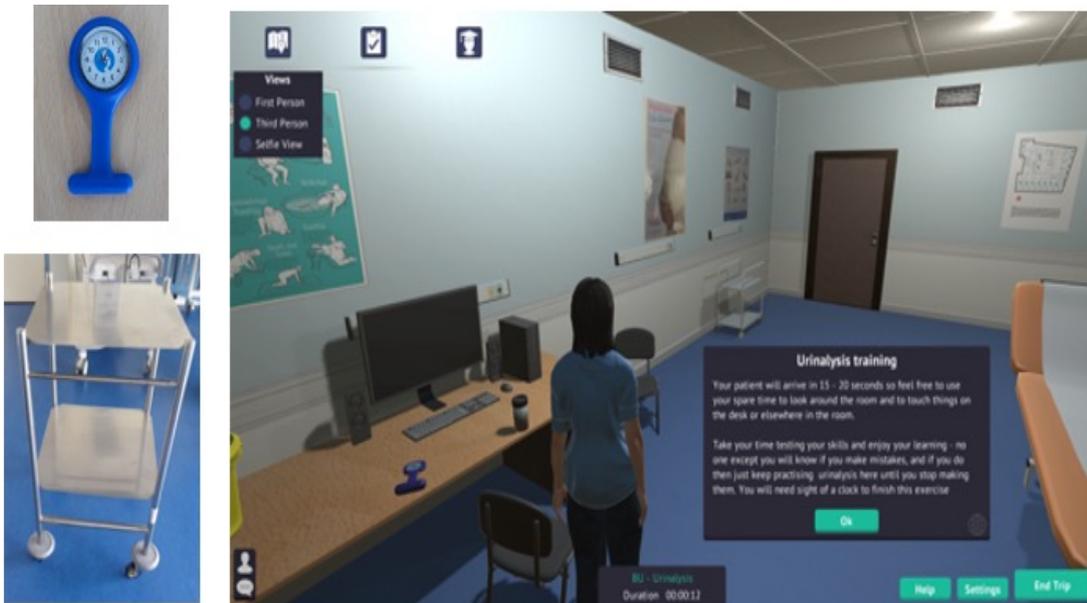
Figure 18 - Visual aids and their digital representation in urinalysis VRLE.

Feedback from the phase zero concept testing cohorts commented on the proportions of things being incorrect when experienced in full immersion. This can be seen in Figure 18 above where the desk appears to be longer than usual, as well as other items in the room being out of proportion. These were improved in the phase one safeguarding VRLEs used for this doctoral research project.

Technical developers send the content author a 'blank slate' architectural design of the interior of the home based on the requested floor plan specification. The one for the Melser family home can be seen in Figure 19 below.
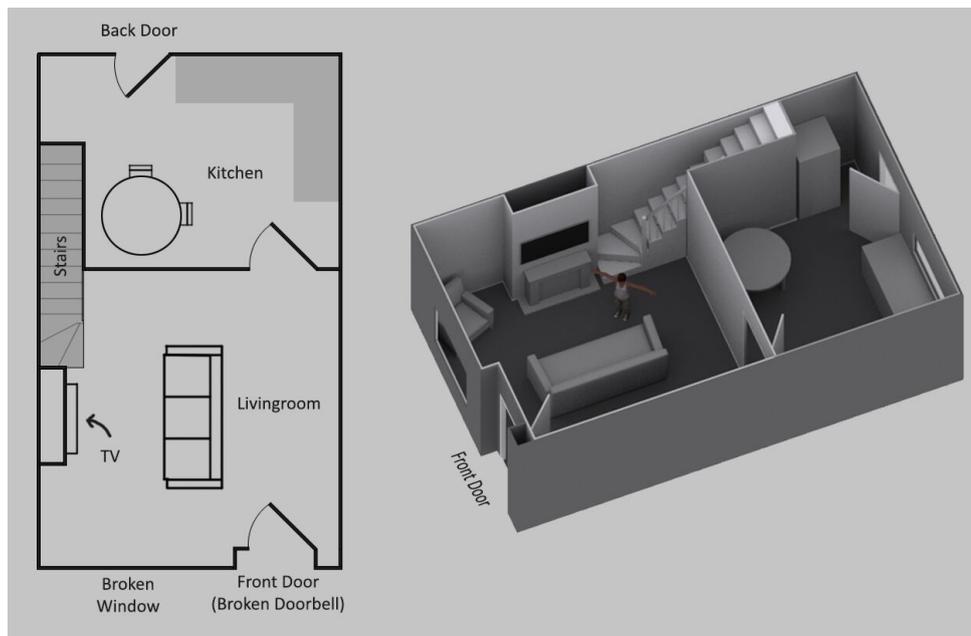
Figure 19 - Floor plan for Melser family VRLE.

This then needs to be decorated by the developers based on the provided visual aids in order to fit the needs of the scenario that the users will experience in the VRLE. Visual examples of what I wanted the members of the family and the interior of the family home to look like, from furnishings to décor to structural architecture, were provided. For example, the wallpaper in the home needed to be hanging off the wall in places and the cause for this peeling wallpaper needed to be visible as mould on the surface of the wall.

Figure 20 below is an example of photos sent as visual aids (left side) which the developers translated digitally into the representation shown in the screenshot taken from one of the phase one safeguarding VRLE (right side) which shows the improvement in representation of the environment compared to the phase zero concept testing VRLE in Figure 18.

Figure 20 - visual aids (left) and resultant digital representation (right).

5.6.5 Proofing

The VRLE is then developed to the point where the technical architects feel it is ready to be published in beta version. The next step is to being proofing it to look for errors and other aspects which need improving. On average each VRLE needed proofing four times:

- First proof identifying over 100 aspects which needed correction or change
- Each subsequent proof identifying significantly fewer aspects requiring amendment.
- Final proof done when irreducible minimum of errors is noted and all that remain is to look for typos in the text.

Although full editing rights to the VRLE is given to the storyboard content creator even after final sign off, proofing is important because once the VRLE is signed off as complete it is more challenging to make changes to it. Due to the nature of the VRLE structure and my relatively limited skill set in this area, making a change to just one character within a line of text can have a knock-on effect to other areas of the VRLE, which I may not think to prevent thus turning editing into an unnecessarily long task.

5.6.6 Concept testing (phase zero – prior to this doctoral research)

Although the urinalysis VRLE (phase zero, Appendix 5) is not part of this research it is necessary to discuss it here as action research is comprised of various elements and sometimes those connect in unexpected ways (McNiff and Whitehead 2010). For practical purposes this will be referred to as phase zero with the main research for this project referred to as phase one. The urinalysis VRLE gave rise to the safeguarding VRLE (phase one, Appendix 5) that were created for this research – ones which offered opportunities to practice soft skills including humanisation of care and clinical intuition. Before phase zero this was not something I had considered creating within a VRLE experience and as discussed in Chapter Four this is an example of why action research is a good fit for the complexities of healthcare education research particularly when this is compounded by attempting to develop tools that are flexible enough to be used by students from more than one healthcare profession.

As discussed in Chapter Four and this chapter, phase zero (Appendix 5) offered me opportunities to test out the recruitment process, mixed method data collection and analysis. To do these things involved the offer of help from a small number of midwifery students who agreed to concept test the urinalysis VRLE and contribute to quantitative and qualitative data collection. They were given an information sheet which explained what they could expect when they accessed the VRLE (Appendix 12). They used a variety of handheld devices – laptops, tablets and smart phones - to access the urinalysis VRLE and practice their clinical skills for urine testing, after their session spent learning the theory for this clinical skill. This allowed them to consider the difference between having the theory taught traditionally and taught within the VRLE as well as whether the VRLE allowed them to practice the requisite clinical skills.

During phase zero, RPs highlighted that the VRLE was an interesting alternative way to learn which gave them learning autonomy and helped build their confidence.

> *"Found the virtual environment did not necessarily teach me new things, it was confidence building and reaffirmed knowledge. It bought to life universal precautions, techniques and clinical knowledge in a meaningful way, especially for visual/practical learners."*
> (Questionnaire ID [QID] 2292, L.302)

This student pointed out that, although they enjoyed the VRLE learning experience on the whole, in places there was too much text to read during the theory parts of the VRLE.

> *"I think the thing that I felt actually was um ..... it was it was good, it was interesting and it reiterated what we'd learnt and it's good to keep up the sort of*

the technique or the practical side of it um and then it throws in the bits of theory but I did find that at one point the theory bit got quite heavy, there was loads and loads of stuff to read."
(S1, L.16)

This student went on to suggest that this could be improved by including more multiple-choice options.

"…if perhaps you do it some by some there's multiple choice so say for instance you do the test and oh there's a little.... it shows up as a little bit of protein um what could this demonstrate and maybe there's a selection of answers."
(S1, L.16)

Additional complications to the urine testing was also suggested as a way to maximise the learning available in the VRLE.

"…or you could do, each one could have a different um urine [laughter] you know like one could be cloudy um and or odourless or have, be red or ..... you know so there's different you know so you don't just use it the once you could go in multiple times."
(S1, L.21)

They suggested the VRLE could be useful to bridge the gap between learning theory and going out on clinical practice placements to put those skills to use.

"..... and going into practice that sort of bridging the gap tool. I wouldn't say you could use it as an absolute tool to learn how to do urinalysis, you have to be able to do it and practice it in real life as well but for bridging the gap I did think it was quite useful."
(S3, L.214)

Though students were also keen that the VRLE did not replace traditional methods of learning.

*"I just, I really just wanted to stress that I **do** think with whatever skill this can be made to do, we still should have to do it physically in the Skills Lab. I don't think we can lose that I think that's really really important to have the hands-on but it is definitely a good thing for like what I call bridging the gap."*
(S5, L.288)

"I believe traditional kinesthetic [sic] learning would be preferable for all clinical skills. I would not like to see that being lost but i do think it is a viable option for bridging the gap. However as an additional not as replacement for conventional learning."
(QID 4247, L.301)

There were also comments about how it was useful as a place where they could make mistakes without real-life consequences.

> "Safe environment to make errors, in a non-judgmental way. Also boosted confidence by having a baseline knowledge and answering questions posed correctly."
> (QID 2292, L. 302)

> "..... so that way you you've kind of got that stage so you are learning in the classroom where your you've got your supervisor, you're being told how to do it and then you've got this opportunity where you're not going to make a mistake by yourself, so you'll sort of be doing it more independently and it gives you more confidence for when you are actually out in practice and you **are** doing it for real."
> (S4, L.215)

The quote below led me to consider whether having the opportunities to do tasks like these within the VRLE would allow them to practice humanising their care in addition to doing clinical tests such as urinalysis.

> "I also like the little tips on what's the nicer way of greeting the woman um as opposed to just "come in" [laughter] you know you go to the door and welcome them and "take a seat" and um all the rest of it. That was quite nice."
> (S1, L. 32)

To attempt to gain some clarification, I emailed the students who had trialled the concept testing prototype to ask a further question:

> "Thank you so much for taking part in the research on the urinalysis VR learning environment (VRLE). On the whole you have said that the urinalysis VRLE improved your confidence, knowledge and reasoning related to urinalysis when you were in the gap between learning the theory and your clinical practice block. I am now working on developing the next VRLE which will be related to safeguarding where you will be able to use VRLE to enter a simulated client's home and practice your safeguarding skills there and during a simulated child protection conference. What I would like to know (in addition to the feedback you have already given me) is: in your own words what way(s) you feel the use of VRLE can impact on patient care in clinical practice?"

There were replies from two students (Appendix 9):

> "I feel that being able to access and use the VRLE will increase our confidence in practice because it will allow us, as students, to walk through an entire scenario from start to finish so that when it happens in practice it isn't the first time. Likewise, if we require extra practice on top of certain scenarios we face in practice, it'll be a really valuable tool to contribute to our knowledge and experience of a certain area of patient care. I think that the overall impact will be an improved learning experience for the student and, as a consequence, better care for the patient from a more confident practitioner. I, myself, think that if I

> *had regular access to a virtual learning environment where I could choose areas that I wanted to expand my knowledge on, I would use it regularly alongside practice as well as when studying blocks of theory."*
> (NB)

The other reply below made me wonder if along with supporting students to practice humanising their care, perhaps the VRLE could provide a space for students to also practice their clinical intuition skills.

> *"I personally think that the safeguarding VRLE could prepare us more for when we are in practice. Likewise with the urinalysis it will broaden knowledge and confidence when being putting [sic] in these situations. It may help to identify potential issues earlier than we may have done without the practice on the VRLE. Allowing us to go into an environment (in this case a home) where we can practice before being put in a real life situation, I think would be beneficial. Practicing conversations, the right questions to ask and the signs to look for could help protect vulnerable people quicker. It will give an insight into child protection conferences that some newly qualified midwives may not have witnessed previously, this in itself will be less daunting for some possibly. Having the experience of a conference will enable healthcare professionals to explain what the process is to patients and answer any questions they may have. Practice brings confidence and knowledge, so with regards to patient care I feel it will help towards better communication and trusting relationships quickly."*
> (RM)

Additionally, as highlighted in Chapter One and discussed in Chapters Six, Seven and Eight, humanisation of care and clinical intuition are irrevocably linked to holistic healthcare and therefore are a vital part of a healthcare professional's skillset. Therefore, based on the feedback from the cohorts' concept testing the prototype, when designing and storyboarding the subsequent VRLE for this research project adaptations were made in an attempt to support practice of challenging conversations, humanisation of care, use of clinical intuition, and increased options for learning in relation to the subject were built into the VRLE. The literature was searched (Chapter Two) prior to this to ensure this research had not already been undertaken and to support development of the research questions. In Chapter Four, the methodology choice of action research viewed through a phenomenographical lens is explained. In short, this requires that feedback is considered from a collective perspective in order to be representative of the RPs views as a whole and then acted on as necessary to improve the project.

The concept testing (phase zero, Appendix 5) used a urinalysis skills VRLE and the main research (phase one) used VRLE designed to support healthcare students with learning and application of skills necessary to safeguard families. Although these VRLE topics are quite different, it did not pose any problems with the research in either case

as the research was not about the subject being learned in the VRLE but instead the RPs' experience of learning using VRLE. The observation section of phase zero was used to receive feedback and utilise the feedback to produce the more refined versions of the VRLE (phase one and the branches). This is depicted in the spirals detailed in the generative transformational process in Figure 4 (Chapter 4, section 4.4.3.1). It is intended that the VRLE for the main research is regarded as the first phase of this action research because the feedback from the concept testing (phase zero, Appendix 5) was considered and applied to the next iterations of the VRLE action which are the VRLE used for this research.

5.7 Funding

The funding was sourced for the full research project VRLE from the budget of the Bournemouth University (BU) Health and Social Sciences faculty. Daden Ltd. is the Small Medium Enterprise (SME) who built the VRLE based on the storyboard design and content which I created (see Appendix 11 for a one-page extract of each).

5.7.1 Licencing

The VRLE were situated on the developer's Trainingscapes platform and accessed via user licenses which are purchased yearly. This cost for outsourced platforms which allowed access to the VRLE environment offered benefits in respect of secure firewalls and a safe and well-maintained environment for learning (Daden 2019). However, there are positives and negative aspects to having to access the VRLE through a platform which does not belong to the University.

Positives

- These licenses are not user specific so they can be reused faculty wide throughout the year simply by enrolling new users on once the previous user is finished.
- There is skilled, easily accessible, rapid response, VRLE specific IT support available as part of the user license fee.
- The user licenses are not restricted to the University student emails and therefore can be used for research participants in different areas of the world.

Negatives

- The user license fee is more costly when purchased in small batches (ie: under 500)
- The full user license funding is difficult to source internally and requires ongoing work to secure outside funding.

- The enrolment process for users is clunky and time consuming though Daden Ltd. were working on measures to improve this aspect.
- The SME discontinue the education arm of their platform.

5.8 Chapter summary

This chapter has concentrated on discussion of the VRLE design and creation including how the phase zero concept testing of the urinalysis themed VRLE prototype (phase zero) contributed to shaping the subsequent safeguarding themed VRLE as part of the action research for this doctoral research (phase one, Appendix 5). In the following Chapter (Six) the quantitative data will be analysed and provide the outline to the research findings which will be filled in by the analysis of the qualitative data in Chapter Seven.

Chapter Six: Quantitative data collection and interpretation

"It is when we go beyond instinct that we seem most idiosyncratically human. Perhaps, as Darwin suggested, the difference is one of degree rather than kind; it is quantitative, not qualitative (Ridley 2003, p.32)."

6.1 Introduction

Questionnaires were chosen as the collection method for the quantitative data as this facilitated gathering data from the numerous RPs with ease, which would not be possible with qualitative data collection. This quantitative data analysis will highlight areas which will benefit from more in-depth exploration through qualitative data collection (Darington and Scott 2002). However, only the data from questions relevant to the research questions were analysed using SPSS. The data from other questions were not analysed using SPSS, but the relevance of their inclusion will be discussed. Finally, some of the open text comments (indicated by questionnaire numerical ID [QID] and line number) will be included as needed to round out the discussion of the analytical findings. The relevance of data collection to the research questions is discussed in section 6.2.1 – 6.2.3 followed by critical analysis of the data from section 6.3 onwards.

6.2 Questionnaire design and content

The questions chosen for the questionnaires (Appendix 5) explored the RPs' opinion before and after use of VRLE. This was to establish a baseline and then measure changes in RPs' perception of VRLE impact on all the aspects required to answer the three research questions.

6.2.1 Relevance to research question one

What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?

This question sought to discover the impact of the experience within the VRLE on the RPs ability to use their clinical intuition as part of their decision-making process within the VRLE. The questionnaires included questions related to clinical intuition such as:

- Asking RPs about their perception of the impact the experience within the VRLE had on stimulation of their clinical intuition.
- Exploring RPs' self-reported confidence in clinical skills specific to safeguarding before and after use of the VRLE.
- RPs' levels of confidence in general clinical skills.

6.2.2 Relevance to research question two

To what extent does healthcare students use of VRLE relate to the humanisation of their healthcare?

This question explored the impact of VRLE on the RPs' ability to humanise their healthcare. The questionnaires included questions which examined:

- Impact on aspects of delivery of holistic care such as Care, Compassion, Competence, Communication, Courage, Commitment.
- Any changes in feelings about patient safety linked to their healthcare provision.
- How effectively they considered theory and practice was combined within the VRLE.

6.2.3 Relevance to research question three

To what extent does the VRLE functionality impact healthcare students' perception of their ability to engage with the given scenario?

 This question considers the impact of VRLE technical functionality on the RPs' ability to immerse in the healthcare scenario within the VRLE. The questionnaires asked RPs to contribute their opinions on

- Any experienced limitations of VRLE
- RPs' belief in the value of using VRLE for learning

RPs were asked to contribute responses for questions displayed as; Likert belief scale with an open text option, the Thurstone yes / no scale with open text option, nominal scales with an open text option or as open text answers only. Responses of 5 and above for the Likert belief scales were chosen as the indicator of positive impact in order to reflect the opinion of the majority of RPs as well as to acknowledge and reduce the possibility of skewed / distorted variance resulting from use of a 10 point Likert scale (Garland 1991, Jordan 1996, Cummins and Gullone 2000, and Dawes 2008).The variety of question styles was included to sustain RP interest and engagement with the questionnaires by avoiding posing too similar answer options (Scott and Mazhindu 2014). However, it was realised after analysing the different data gathering question types, that the Thurstone yes / no scale questions did not provide enough variance within the RPs' answers, which limited the analytical findings compared to that gained from the Likert belief scales. This will be discussed in relation to each question in order to clearly demonstrate the perceived limitations.

The open text answer option was included for each question to provide RPs with opportunities to explain their choices or to accommodate inclusion of additional information not asked for by the researcher (Jacobsen 2017). Each RP was asked to complete the post-action questionnaire once they had experienced the VRLE as many times as they wished to do so. Pre- and post-action contributing RPs answered all questions which supports the concept of using fewer numbers of questions in order to keep RPs engaged with the questionnaires (Jacobsen 2017).

6.3 Critical analysis of the questionnaires' data including limitations and adjustments

The pre-action questionnaire was completed by all 311 RPs who agreed to participate in the VRLE experience and the post-action questionnaire was completed by 81% of the RPs (n= 253 out of 311). Large numbers of RPs contribution to quantitative data allows for generalisable conclusions to be drawn (Yilmaz 2013) and this is recognised to be important for healthcare related research (Polit and Beck 2010; Kreiter and Zaidi 2020). The difference in sample sizes is acknowledged as a limitation in relation to being able to comparatively analyse the data with confidence (Chapter 4, section 4.5.3.3). In order to rectify this, the differences were adjusted for though use of SPSS analysis and presented in various forms depending on which are most suitable for the question format (Scott and Mazhindu 2014; Kara 2012; Smith 2023). There was also a limitation due to the RPs not being linked as individuals pre- and post-action through use of an individual token. However, the sample mean and sample standard deviation pre- and post-action is able to be produced using SPSS. These values can be linked to confidence intervals which give boundaries to the margin of error and allows inferences to be made in relation to the RPs data compared to the general healthcare student population (Smith 2023).

As discussed in the Methodology Chapter (Four), the open text responses from the quantitative data and the qualitative data gathered during the focus groups were analysed using thematic analysis. Thematic analysis is widely considered to support healthcare researcher's analytical autonomy along with offering a fusion between quantitative and qualitative data findings (Braun and Clarke 2014; Forister and Blessing 2020). The themes from the open text responses will be discussed in more detail in the qualitative data analysis in Chapter Seven.

Where there is pre- and post-action data, the findings will initially be discussed individually, including selections from the open text contributions to add clarity. For

responses to questions the cut-off point on the Likert scale encompassed the point the respondents predominantly chose. This pragmatic validity supports the drawing of conclusions related to the collective opinion of the RPs when considered in conjunction with qualitative data (Premkumar 2005; McDonnell and Donnelly 2013). Following this, the data for both pre- and post-action was analysed using SPSS to determine whether the change in perception was statistically significant.

6.3.1 Technologies used by RPs for past education
RPs were asked:

What technologies have you previously used in education?

Of the 311 respondents who contributed to this open text answer 97.1% (n=297) stated that they had previously used educational technology in various forms ranging from emails to computers (Figure 21).
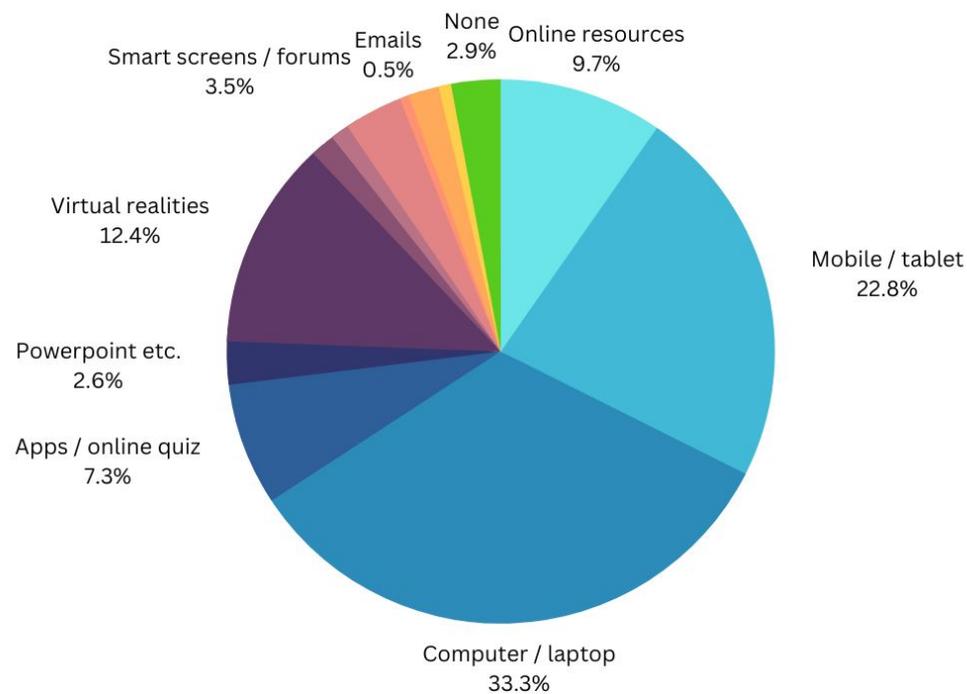
Figure 21 - Technologies used by RPs in education pre-action.

The RPs were expected to be able to engage with research which was technology based so the responses for this question were reassuring. From their responses assumptions could be made about the level of support that might be required when expecting them to download and use the VRLE as part of this research. The majority of RPs indicated that they were familiar with using computer and handheld mobile device technology. As these were the devices through which the VRLE could be used, it was expected that the RPs would need minimal support to engage with and use the VRLE technology (Piovesan et al. 2012; Schindler et al. 2017). This question was also asked

to gather data for all three research questions as the degree of familiarity with using technology will have an impact on the RPs' experience using VRLE.

6.3.2 Research participants' previous experience with use of virtual reality
RPs were asked:

What is your previous experience with virtual reality technology?

This scoping question was asked pre-action only in order to understand whether this factor impacted their reaction to the VRLE. This question has relevance to research question three as research has shown that lack of familiarity or confidence in technology can negatively impact the expectations and / or perception of the virtual experience (Rose et al. 2006; Outlaw and Duckles 2017; Rogers et al. 2019). Of the 311 RPs, 37% (n= 116) replied to say they had previous experience using VR technology. The concept testing pilot study (phase zero) had indicated that this number would be low. Phase zero data analysis also indicated that additional advice was required to support download of the VRLE and RPs' preparation for use. After reflection, revision to this aspect was made to provide this additional advice to improve user experience from the beginning of their connection with the VRLE (Appendix 12 and 13). Furthermore, the SME platform that the VRLE were hosted on also continued to offer built in tutorials on the basics of how to use VR in the VRLE which is expected to act as a failsafe for users requiring additional support.

6.3.3 Research participants' perception of whether VRLE can support learning

6.3.3.1 Pre-action
RPs were asked:
Do you think that Virtual Reality Learning Environments (VRLE) can help you to learn something new?

Responses to this question demonstrated that a high percentage 92% (n=286) of RPs had a positive expectation of the VRLE as a learning tool. This positive expectation was encouraging when the fact that such a small percentage indicated that they had previous experience of using VR is taken into consideration. As discussed in the Methodology Chapter it is not uncommon for there to be resistance to the introduction of new ways of working or learning (Currie 1999; Power 2016). Some might argue that as the RPs had agreed to take part in the research then they may already be in a positive frame of mind about the concept of using VRLE but in the concept testing

(phase zero) it was demonstrated that some RPs agreed to participate despite not feeling positive about VRLE.

It is to the RPs' credit as healthcare students that they demonstrated this willingness to show positivity towards the VRLE despite it being a new experience. As healthcare students and future practitioners, they will need to be able to be open and adaptive to unexpected change (Ramaci et al. 2019; Garner and Golijani-Moghaddam 2021). This question is expected to support data gathering for research question three which is considering the impact of VRLE functionality on RPs' ability to engage with the scenario.

All respondents were able to offer additional information if they wished to do so by using the open text box. However, the 5.8% (n=18) who chose the 'other' option and the 2.9% (n=9) who chose 'no' as their response were specifically asked to give additional information to explain why they had answered this way.

The most common opinion from RPs open text responses for this question was that they simply had no previous experience so could not make a prejudgement:

> *"I have no idea as I have no previous experience of VR."*
> (Questionnaire data ID (QID) ending in 0696, L.199)

Other RPs added clarity by stating that they did not feel able to answer because they didn't know whether the VRLE would be fit for the purpose they were using it for:

> *"It depends on the learning environment and the target audience."*
> (QID 2834, L215)

Information such as these quotes above indicates that the RP felt unsure about what to expect and therefore were not able to make a decision about whether they felt it would offer them new learning.

RPs also demonstrated that although they were not feeling negative about what VRLE could offer as a learning experience, they equally were unconvinced about what the experience would be like:

> *"In theory this could significantly benefit students if a good system is used."*
> (QID 9792, L. 227)

Some RPs seemed to have taken part in the concept test (phase zero) with differing feelings about the potential impact of VRLE due to this experience.

> *"It appears fairly stilted and artificial. Misses a lot of the more subtle nuances such as body language, tone of voice found with real people."*
> (QID 0740, L.234)

> *"I found use of VRLE at Level 4 very useful as it allowed me to be more direct and push for more information than I would feel comfortable in usually - this really helped to show me what is acceptable in the professional role that I am looking to go in to. I hope that this further use of VRLE will build on the confidence that I gained at Level 4."*
> (QID 0603, L.272)

Finally, in one case the RP had a misunderstanding about what the VRLE would allow them to do:

> *"Rather than learning stuff from VRLE, I think it will be useful to practice and reinforce things learnt in theory."*
> (QID 0533, L. 198)

The purpose of the VRLE is to provide a space to practice and reinforce things they had learned in theory and this is where the anonymity of the responses is unfortunate as it would have been interesting to be able to follow these RPs up to see if their opinion had changed once they had experienced the safeguarding VRLEs. This would have generated new knowledge with which the VRLE could have been developed in responsiveness to the RPs' feedback while the research process was ongoing as part of the action research generative transformational process (McNiff and Whitehead 2009).

6.3.3.2. Post-action
Did the Virtual Reality Learning Environments (VRLE) for safeguarding help you to learn something new?

Despite the high numbers who had indicated pre-action that they wished to use VRLE as part of their learning, there was a slightly smaller number post-action who felt that the VRLE had in fact helped them learn something new however the difference in sample sizes is a limitation. There were 81.8% (n=207) who answered yes to this question, 15.8% (n=40) who answered no.

Others choose to leave an explanatory text comment which related to answering research question three about the impact of the VRLE functionality. Some of those who

had experienced technical difficulties seemed to feel this had impacted on their ability to engage with the scenario in a beneficial way.

> *"It was really laggy and didn't work massively well but was funny."*
> (QID 3345, L.294)

Some RPs seemed concerned that the VRLE would replace traditional teaching methods.

> *"Not as much as if we were to go through powerpoints or have a go at some activities around the unit."*
> (QID 3554, L.295)

Some indicated that they appreciated the VRLE as an experience or a place to refresh existing knowledge despite not perceiving that they had learned anything new.

> *"Not necessarily new but definitely reinforced some knowledge."*
> (QID 3303, L.299)

However, despite the functionality issues, these responses and quantitative data overall do demonstrate that RPs feel that they are able to engage with the scenario within the VRLE. Additionally, the RPs data suggest that VRLE can support users to learn new things or to reinforce existing knowledge while experiencing the VRLE. Cooperstein and Kocevar-Weidinger (2004) recommend facilitating effective learning by building on prior knowledge while offering task-based learning to support learners constructing their own meaning during further deep learning. Therefore, combining existing theory-based surface learning with the VRLE available for use as a practical application tool to deepen learning meshes with their recommendations. Research conducted by Boer (2017) suggests that this process has been shown to transfer itself from virtual practice to traditional application of skills. The responses of the 18.6% who provided additional feedback contributed to answering research question three by demonstrating that the functionality of the VRLE does impact on their learning.

The questionnaire responses seem to indicate that fewer RPs felt the VRLE helped them to learn new things than expected pre-action. To be certain that this is correct the RPs perceptions pre- and post-action were analysed using SPSS. It can be seen on the confidence interval (CI) graph (Figure 22) that there was an increase post-action in their perception that VRLE for safeguarding could help them learning something new. The standard error difference was 0.23, there was a 95% CI [.160, .0.72] and the p-value was 0.001 so therefore an inference can be made that the RPs increased belief

that the VRLE for safeguarding helped them to learn something new is reflective of the general healthcare student population.
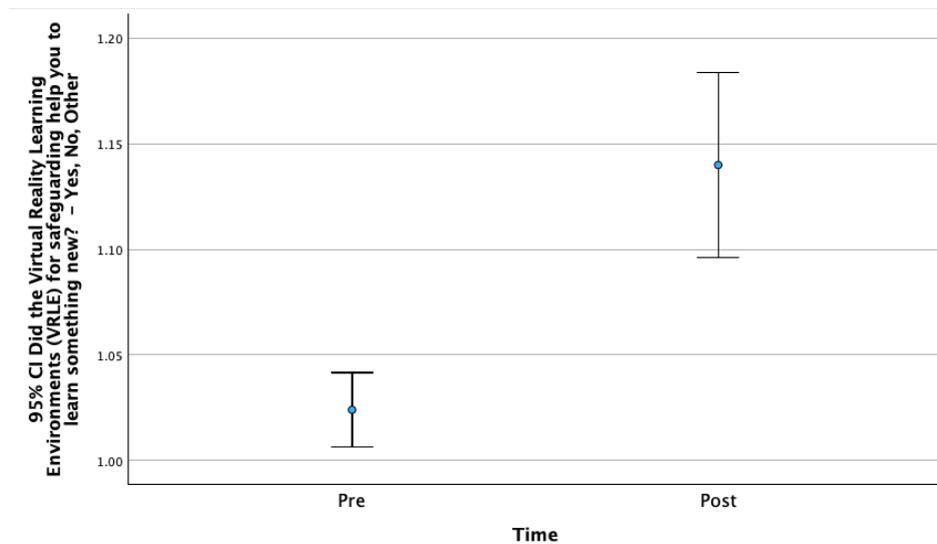
Figure 22 - CI whether VRLE use impacted on learning something new.

6.3.4 Current confidence in clinical skills for safeguarding

6.3.4.1 Pre-action
RPs were asked:

How do you rate your current level of confidence in clinical skills for safeguarding before using the Virtual Reality Learning Environments (VRLE)? Please rate from 1-10 with 1 being 'no confidence' in your clinical skills.

Safeguarding families was the topic for the profession generic VRLE used for this research. This question explored the RPs self-perception of their confidence in skills for safeguarding families before experiencing the VRLE and is intended to generate data for research questions one and two. The 323 responses indicates that some RPs chose more than one number rating for the perception of their confidence, which as discussed in Chapter Four is a limitation imposed by questionnaire design error.

As discussed in Chapter Four (section 4.4.3.2), viewing the responses with a phenomenographical lens facilitates exploration of the RPs collective opinion. For the responses to this question, it can be seen that the respondents predominantly felt some confidence in their pre-existing skills to safeguard families, with 86.8% (n= 270) rating their confidence at 5 or above, therefore this was the cut-off point for this category. The 15.8% (n=49) who rated their confidence at lower than 5 could be those in earlier years of their degrees or those with less safeguarding experience compared to other respondents and this will be discussed in detail in Chapter Six (section 6.6.2.3). Power (2016) argues that their survey of third year student midwives indicates that individual expectations of their own performance and confidence in their abilities

can plummet under the perceived pressure to be career ready. With this in mind it can be inferred that the smaller percentage of less confident respondents could equally include students at any level of their degree.

6.3.4.2 Post-action

This question once again invited them to reflect on their level of confidence specific to safeguarding families in order to see if their level of confidence had changed now that they had experienced the VRLE (fig 27). The percentage breakdown indicates that one respondent chose more than one answer with 100% (n = 254) now rating their confidence at 5 or higher. Fewer respondents completed this questionnaire, however, there still appears to be reduction in the number of RPs choosing confidence level 4 or lower, 4.4% compared to the pre-action answers of 15.78% for this question which indicates an increase in their collective perceived confidence. It has been suggested that self confidence in clinical competence is a key component required to be able to develop the ability to use their clinical intuition which is the focus of research question one (Keene et al. 2022; Ward et al 2021; Nibbelink and Brewer 2018). Leisher et al. (2023) take this one step further by suggesting that perceived confidence itself is indicative of the use of clinical intuition.

To be sure of the accuracy of the comparison above – that there was an increase in confidence in safeguarding skills after using the VRLE – SPSS analysis was performed (Figure 23).
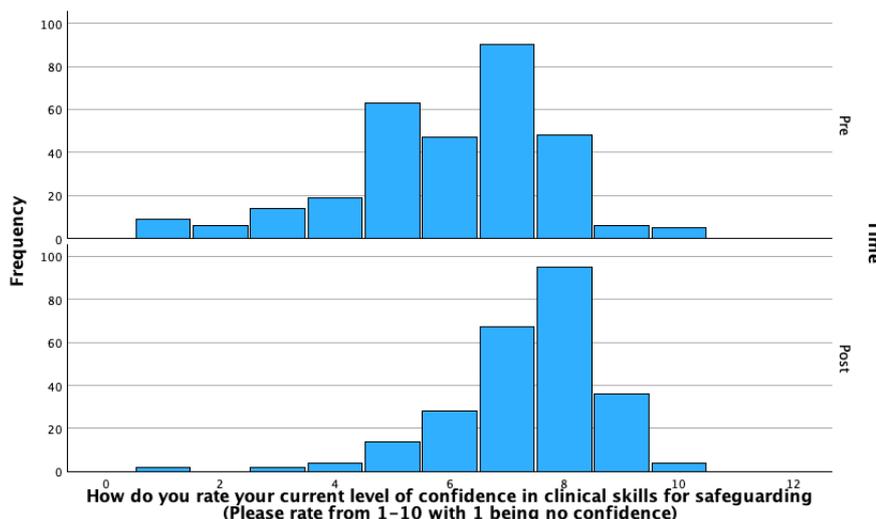
Figure 23 - Change in confidence in clinical skills for safeguarding pre and post-action.

Additionally, there was a 95% CI of 6.04 pre-action and 7.36 post- action [1.593, .1.051] (CI graph xx), the standard error difference was .138 and the p-value was 0.001. It can be seen on the CI graph (Figure 24 below) that there was an increase

post-action in the RPs perception that VRLE used had improved their clinical skills for safeguarding. From this SPSS analysis it can be concluded that the increase in confidence was notably significant despite the difference in the sample sizes.
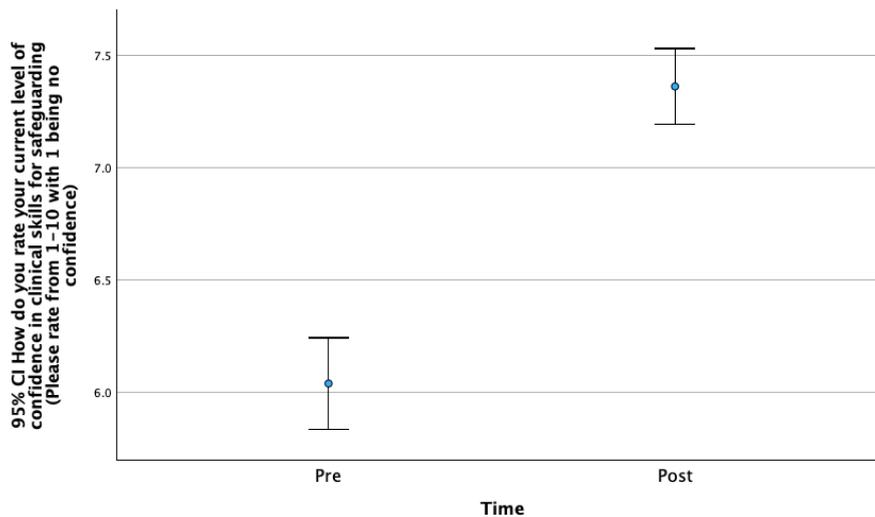
Figure 24 - Indication of change in RPs' confidence in clinical skills for safeguarding pre- and post- action.

Overall, the evidence is strong enough to infer that this difference was caused by the VRLE use and that these findings indicate the impact that could be expected for the general healthcare student population as well. Opportunities to have safeguarding experiences and to practice these skills are varied and unpredictable within the real-life clinical learning environment. VRLE can be seen to offer clinical experiences which cannot otherwise be guaranteed, and the responses demonstrate that the RPs felt these were a valuable contribution to their learning. This was deconstructed further through focus group contributions and will be evidenced in Chapter Seven (sections 7.6.3.1and 7.6.3.2).

6.3.5 Current confidence in clinical practice

6.3.5.1 Pre-action
RPs were asked:

> *Please rate your belief that Virtual Reality Learning Environments (VRLE) can help improve*
> *confidence in clinical practice. Please rate from 1-10 with 1 being no belief.*

Again, the answers predominantly were scored at 5 or above by 94.8% (n=295) of the 311 respondents. Included open text comments demonstrated that there was a mix of positivity and uncertainty.

"If it is a scenario that the student has very little experience of in practice, it could be helpful prior to gaining more practice experience."
(QID 0740, L.224)

"Unsure as haven't experienced it yet."
(QID 8794, L.225)

Williams et al. (2018) highlighted the importance of healthcare students being able to use VR to gain experience and develop confidence in skills or management of clinical situations where real-life access to these experiences can be difficult to achieve. As discussed in section 5.3.4, there is support for the premise that RPs' self-perceived confidence is an important aspect related to their ability to develop their clinical intuition (Nibbelink and Brewer 2018; Ward et al 2021; Keene et al. 2022; Leisher et al. 2023). However, it should be considered whether experience will also increase self-perceived confidence. In turn this circles back to the question of whether confidence improves clinical intuition and increases use of this clinical skill. For this research, clinical intuition uses and development within VRLE is considered by research question one because there are a number of aspects of clinical care, such as safeguarding families, in which it can be challenging to gain enough experience to increase confidence in this skill, whilst still a student.

6.3.5.2 Post-action

After use of the VRLE an increase in confidence was reported by 94% (n=238) of RPs rating their confidence at 5 or above post-action use compared to 86.8% pre-use. In order to be sure of the accuracy of the comparison above – that there was an increase in confidence in clinical practice after using the VRLE – SPSS analysis was performed.

The SPSS analysis results demonstrate that the confidence in clinical skills has increased in a significant way after use of the VRLE but as can be seen in Figure 25 below, there is a much smaller difference between the two data sets than with the previous questions discussed so far.
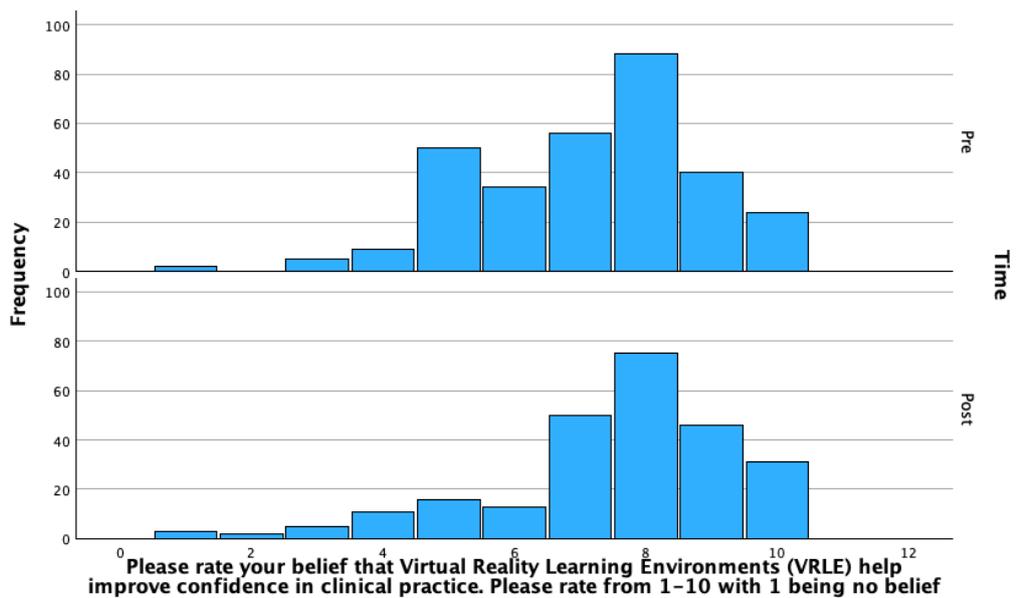
Figure 25 - RPs' belief that VRLE helped to improve confidence in clinical practice.

There was a 95% CI of 7.15 pre-action and 7.53 post- action [0.679, 0.079] (Figure 26 below), the standard error difference was .153 and the p-value was 0.013, so there is a significant different to be representative of the general healthcare student population, but the difference is still a small one.
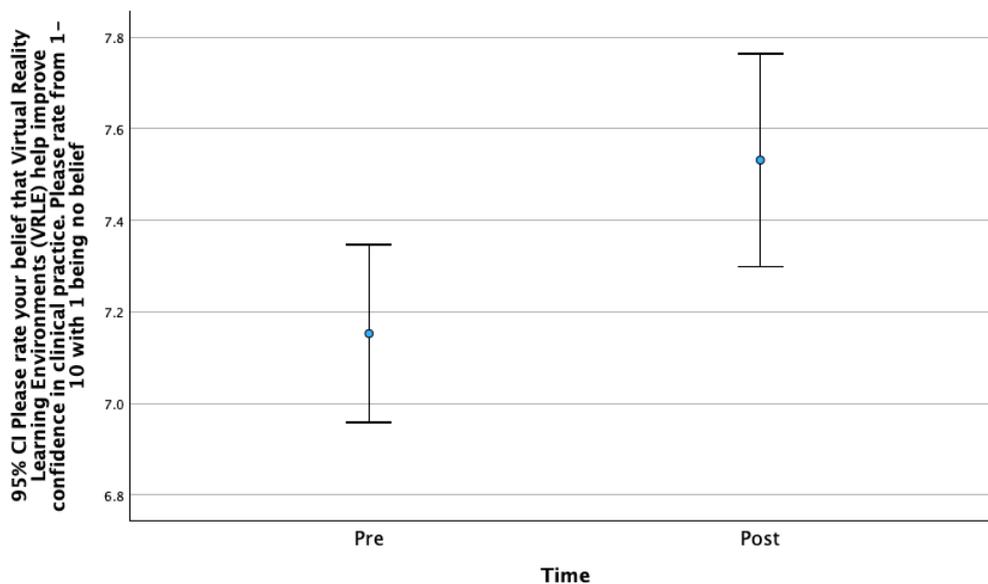
Figure 36 - RPs' belief that VRLE help improve confidence in clinical skills.

Therefore, it must be concluded that the increase in confidence in clinical practice was not notably significant post-action when taking into consideration the impact of the difference in the sample sizes. Whilst the RPs felt that the VRLE was valuable for improving clinical skills for safeguarding as discussed in the previous section, they did not feel it was of use for supporting them to improve other clinical skills. This is likely

because the VRLE did not guide them through practising clinical skills which are more hands on, like the VRLE for urinalysis did in phase zero. This is because it was a safeguarding specific VRLE which drew in on soft clinical skills, but this theory cannot be quantitatively confirmed within this research. Based on these findings it can be surmised that the VRLE are also useful for learning and practising hands on clinical skills but not to an extent where the benefit of the VRLE outweigh other more methods of practising clinical skills.

As discussed in Chapter Three both the VRLE and high-fidelity simulation are expensive but the HFSM are likely to be established in most universities that offer healthcare education. Therefore, based on the analysis for this question it can be seen that it is more likely to be financially feasible to continue with the current clinical skills practice methods. However, the qualitative research (discussed in Chapter Seven) does show that RPs would like additional VRLE (Appendix 7) to practice other skills and does indicate they do believe VRLE could support them with this. Therefore, it would be of value to undertake future research comparing the impact of these safeguarding VRLE with hands on clinical skills practice opportunities built into this along with the soft skills in the VRLE and it is the impact of these skills which has been researched in this project.

6.3.6 Belief that VRLE can bridge the gap between theory and practice

6.3.6.1 Pre-action
RPs were asked:
> *Please rate your belief that use of Virtual Reality Learning Environments (VRLE) can help bridge the gap between theory / practice. Please rate from 1-10 with 1 being no belief.*

The gap between theory and practice is one which healthcare students express concern about in healthcare education as part of end of unit feedback collected by each unit lead. Healthcare students are placed in blocks of theory and placement, and this can mean long gaps between learning the theory of a skill and the ability to gain confidence and competence of this in clinical practice (Bombeke 2010; Haidet 2010; Ellis-Hill et al. 2022). Concern has been raised that this will in turn will impact on the ability for students to gain experience with humanising their healthcare in the clinical context, rather than just in the theoretical context which is the focus of research question two (Scully 2011; Bevan et al. 2015).

In response to this question 96.1% (n=299) RPs rated their belief at 5 or above and respondents left text comments which added clarity to their belief choices.

"In theory this could significantly benefit students if a good system is used."
(QID 9792, L.227)

6.3.6.2 Post-action

Measuring whether the RPs perceived that their use of VRLE had created a bridge between their theory and clinical practice showed that 94.4% (n=228) had rated their belief in this at 5 or above, compared to 96.1% who had felt this way prior to using the VRLE. As there were fewer respondents in the post-action questionnaire it is helpful to look at the ratings of 4 or below as well. Post-action 7.9% (n=20) rated their belief at 4 or below compared to 5.4% (n=17) pre-action which further appears to demonstrate that the RPs do not believe that the VRLE will help bridge the gap between theory and practice. Again, the results are so close that the difference in pre-action and post-action respondents poses challenges for accuracy of comparison between the two data sets.

However, SPSS analysis was able to provide clarity. First, Figure 27 below shows that there is more variance in belief level post-action than pre-action.
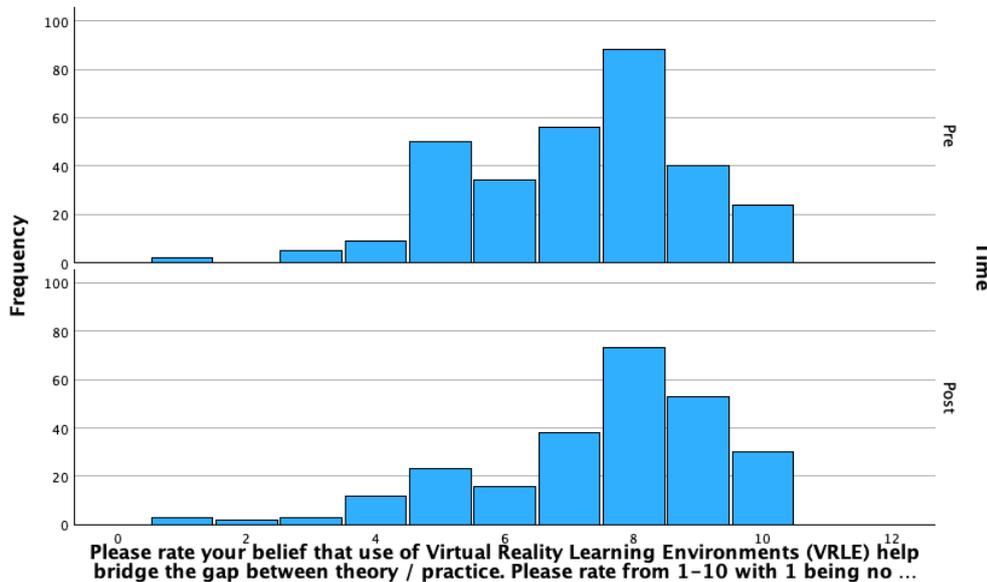
Figure 27 - Change in RPs' belief that VRLE can help bridge the theory – practice gap.

Furthermore, there was a 95% CI of 7.15 pre-action and 7.52 post- action [.667, .063] (Figure 28), the standard error difference was .154 and the p-value was 0.018.

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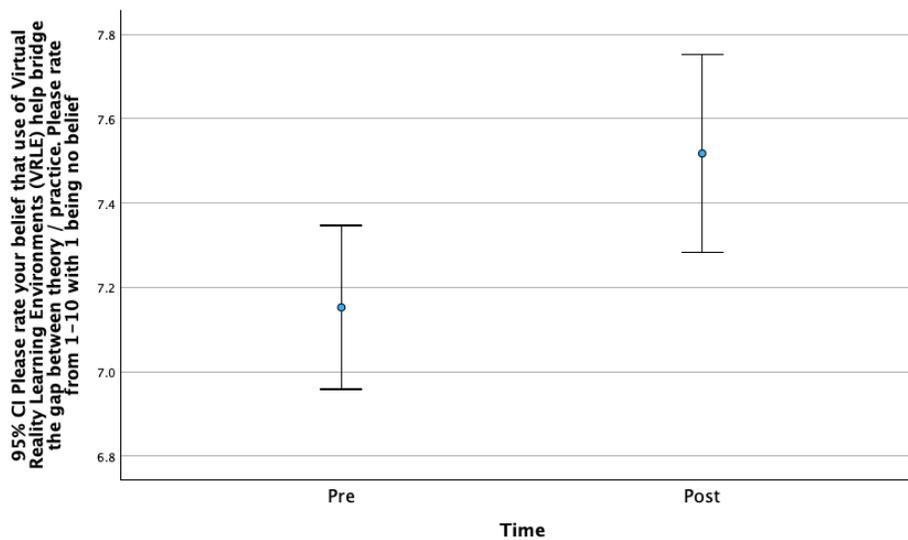
Figure 28 - Change in RPs' belief that VRLE can help bridge the theory – practice gap.

This shows that the belief that the VRLE can bridge the gap between theory and clinical practice has increased to a significant amount after use of the VRLE and these results can be applied to the general healthcare student population. Interestingly, there was noted to be a larger number of outliers who responded with low levels of belief post action. As discussed in section 6.3 there is a limitation in that the RPs were not linked pre- and post-action which makes it impossible to determine any commonalities between these outliers and the RPs as anonymous individuals. Therefore, it would be useful to repeat this as a paired test in order to prove this inference without the limitations. However, belief in VRLE providing useful space for bridging the theory-practice gap does appear in the qualitative data and will be discussed in detail in Chapter Seven (section 7.6.3.2).

6.3.7 Belief that VRLE can support use of clinical intuition

6.3.7.1 Pre-action
RPs were asked:

> *Please rate your belief that use of Virtual Reality Learning Environments (VRLE) for practising clinical skills will help you with learning to use intuitive practice (using your gut instinct). Please rate from 1-10 with 1 being no belief.*

Clinical intuition (also known as gut instinct) is valuable in holistic healthcare for clinical care planning and provision (Stolperet et al. 2011). Clinical intuition can highlight that things may be amiss or be about to go awry before there are an obvious or measurable clinical indicators (Leppakoski et al. 2014). As discussed in Chapter One (section 1.4.3), clinical intuition should be included in healthcare education so it can be used as a clinical skill along with skills from the wider clinical skill set. It was expected that the RPs would be familiar with clinical intuition as a concept, even if they did not feel it was

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something they had personally utilised or witnessed being utilised before entering the VRLE. Belief that VRLE could support honing of clinical intuition skills was rated at 5 or higher by the majority of the RPs 92.7% (n=288) of the respondents.

6.3.7.2 Post-action

Returning to RPs belief on whether they felt VRLE facilitated them practising gut instinct skills resulted in 90.1% (n=228 of 253) of respondents indicating that they now believed VRLE offered them opportunities to practice this skill compared to 92.7% (n=288 of 311) pre-action.

The above figures and comments would appear to indicate that fewer respondents believed that the VRLE facilitated them practicing their intuitive skills post-action. However, as with the previous three questions where the differences were small and with the awareness that the post-action data set had fewer respondents, SPSS was used to provide clarity. Figure 29 below shows a larger proportion of RPs increased in their belief of the VRLE improving their use of clinical intuition post-use is clearly visible.
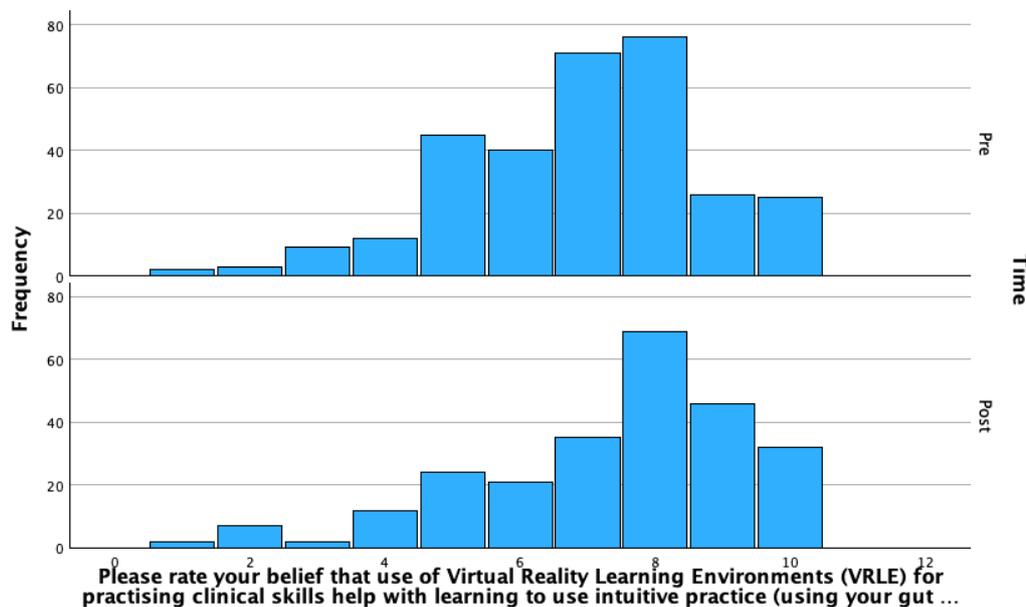
Figure 29 - RPs belief that VRLE can help with practice of clinical intuition.

There was a 95% CI of 6.92 pre-action and 7.39 post- action [.791, .153] (Figure 30), the standard error difference was .162 and the p-value was 0.004. The CI graph shows the amount of change in that improvement determined by the RPs after use of VRLE is quite substantial. Additionally, there were fewer outliers with low ratings of belief post-action compared to pre-action.
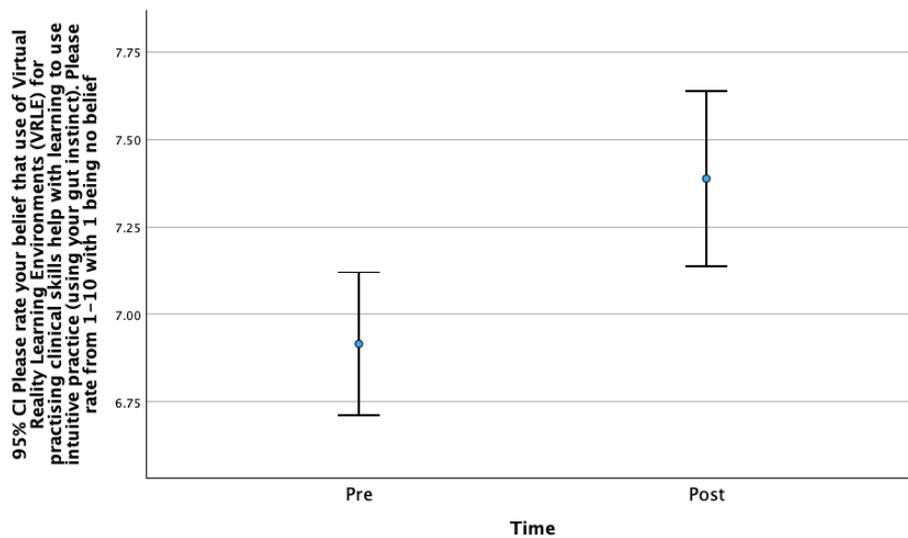
Figure 30 - CI of RPs' belief that VRLE can help with practice of clinical intuition.

It is clear from the SPSS analysis that the RPs increased in their belief that the VRLE could support them with practising their clinical intuition. It is possible that this difference may have been even greater if the level of degree study for each RP was assessed individually. The influence of this factor is evident within the qualitative data in Chapter Seven where there is discussion amongst the RPs that the higher their educational level, the more they believed the VRLE supported them to practice their clinical intuition (theme 2, section 7.6.2.1, 7.6.2.2 and 7.6.2.3). Therefore, future research could explore whether the outcomes would change if the RPs were analysed based on what level of study they had achieved within their healthcare programme at the time of the research.

6.3.8 Belief that VRLE will impact on humanisation of care

6.3.8.1 Pre- action
RPs were asked:

Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an impact on humanisation (the 6Cs: Care, Compassion, Competence, Communication, Courage, Commitment) of your healthcare skills.

The 6 Cs (care, compassion, competence, communication, courage and commitment) are key aspects of humanising healthcare (DHSC 2017). They are therefore important for use in gathering data for research question two. When reflecting on whether VRLE might be able to support them with learning about the 6 Cs, 75.9% (n=236) felt positive that VRLE use could support acquisition of these, 20.6% (n=64) felt that VRLE would have no impact and 1.6% (n=5) felt the VRLE use would have a negative impact on the humanisation of their healthcare skills.

Additionally, some RPs chose to add a text comment. These demonstrated that most were unsure or were reserving judgement until after use and the remainder offered more detailed comments. These included reference to the following:

Uncertainty about virtual environments.

> *"I would say it is difficult to humanise care in a virtual environment so I'm not sure if this will have a positive or negative impact."*
> (QID 2834, L.237)

Concern that there might be a shift to moving away from clinical practice placements.

> *"Not sure really other than through the discussion with others I feel much of the humanisation can only really come with practice, not all theory or virtual."*
> (QID 3294, L.239)

Preference for F2F learning.

> *"Not sure. Not a negative comment, I just prefer to learn in a real classroom or in practice, I don't engage as well with IT. Feels impersonal."*
> (QID 5185, L.240)

It is unclear exactly what VRLE the following RP was referring to as they had not been given their VRLE log in details at the time of completing the pre-action questionnaire but they may have been referring to previous experience with VR.

> *"It appears fairly stilted and artificial. Misses a lot of the subtle nuances such as body language, tone of voice found with real people. Actually, being with real people in real situations develops care, compassion and communication."*
> (QID 0740, L.234)

Although this research was developed with the intent of exploring the collective belief and experience of the RPs, there are instances such as this where it would have been interesting to explore the experience for certain RPs as individuals such as the one above. However, as discussed earlier this is a limitation due to not building in a way to link the RPs as individuals through their contributions on both questionnaires.

6.3.8.2 Post-action

This question brought RPs back to considering the impact they felt VRLE had on the humanisation of their healthcare. Pre-use 75.9% of the RPs had indicated that they were expecting an improvement in the humanisation of their healthcare and post-action 77.9% (n=197) felt they had experienced an improvement. There was also an increase in the number who felt the VRLE had no impact on this skill 22.9% (n=58) compared to 20.6% (n=64) and a small reduction in the post-action number who felt VRLE had a negative impact 0.4% (n=1) compared to 1.6% (n=5) pre-action.

Two RPs left a text comment. One indicated that they believed the VRLE was not a complete solution and the other appeared to believe that VRLE could have a variable effect. It is acknowledged that these comments do little to add any clarity but the qualitative data does add more detail and context so this will be explored in Chapter Seven in theme one for each of the 6Cs and discussed in Chapter Eight when the overall combined findings and their relevance to the research questions are shared.

The SPSS analysis was performed using a chi-square because the answer format was a yes / no / negative rather than a 1-10 scale like previous questions. The chi-square test (Figure 31) shows there is no significant differential ratio in the pre- and post-action responses [pre .466, post .440].

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.527[a]	2	.466
Likelihood Ratio	1.644	2	.440
Linear-by-Linear Association	.005	1	.945
N of Valid Cases	550		

Figure 31- Chi-square test results related to whether RPs believed VRLE would impact on the humanisation of their healthcare skills.

There was a 95% CI of 1.225 pre-action and 1.222 post- action [.0711, .0764] (Figure 32), the standard error difference was .0375 and the p-value was 0.945.
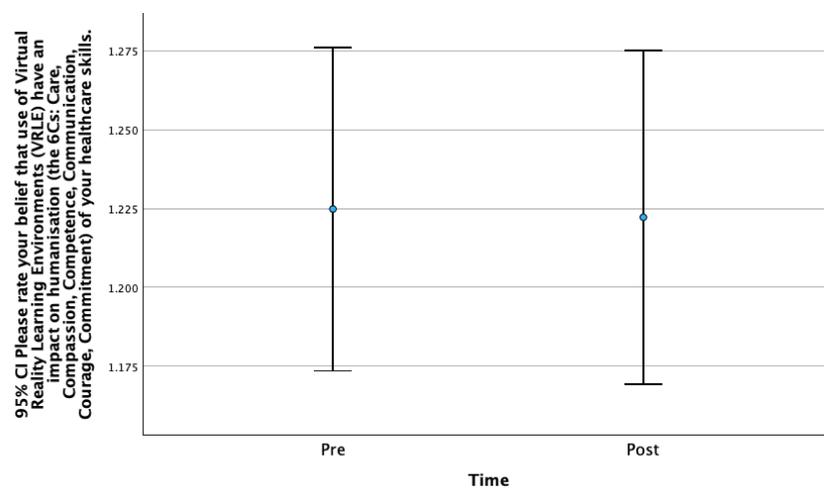
Figure 32 - change in RPs' belief that VRLE can impact on humanisation of healthcare skills.

It may be that those who believed the VRLE could support humanisation of their care did not change their mind post-action whereas the RPs who felt neutral about this may have increased with the increase coming from the decrease in those who had initially expected the VRLE to have a negative impact. Unfortunately, due to the RPs not having a unique linking token pre- and post-action it is not possible to explore this. Furthermore, if the response had been presented as 1-10 scale the RPs will have had more choice of how to rate their belief of the impact on their humanisation of care and the balance may have then been place more definitely at either end of the scale. Therefore, it would be worthwhile repeating this question in further research to gain clarity quantitatively.

As discussed in the pre-action responses section, in order to better manage expectations a different term could have been used to reduce the expectation that the scenario was going to mimic real life in virtual space. Going back to the example of throwing a virtual spider at a VR user, Bertrand et al. (2018) argue that the VR experience does not need to be perfectly realistic for it to provoke a response that would also occur in real life, and that behaviour in VR may differ slightly from that in real life but it does not make it less important. However, it could be argued that expectations can have a more positive or negative impact on the perceived outcome of learning (Sander et al. 2000) and it appears some RPs had entered the VRLE expecting to be disappointed. It can also be seen that they appear to have had a more positive experience than they had expected. As mentioned above this is an area which would warrant further research because the focus group contributions do add enrichment to the RP responses and indicate that the VRLE can help with practising the various elements of the 6Cs. The reasoning and scope of this will be discussed in Chapter Seven and Chapter Eight.

6.3.9 Belief that VRLE will impact on learning

6.3.9.1 Pre-action
RPs were asked:
> *Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an impact with your learning?*

Of the 307 respondents who contributed to this question, 91.6% (n=285) felt VRLE would have a positive impact on their learning, 6.4% (n=20) didn't expect the VRLE to have any impact on their learning and 0.6% (n=2) were concerned that there would be a negative impact.

There were open text contributions, of which some stated they were unsure of the impact and others offered more detail.

This RP shared that they felt unconvinced of the value of VRLE compared to a 'real life' option.

> *"Limited impact, I prefer to learn within real situations with real people."*
> (QID 0740, L.243)

The RP below seems to indicate that positive expectations may have been diminished by concerns about functionality and connectivity.

> *"Some positive but gaining access to virtual reality can be time consuming and having access to download the software is not always available."*
> (QID 2834, L.2467)

These comments add clarity to the expectations of the impact the VRLE would have on their overall learning. However, it can now be seen that the RPs expectations could have been managed better so that they did not go into the experience expecting a mirrored reality. It could be argued that referring to the experience as taking place in *virtual* reality may have added to the heightened expectations and that choosing a different expression may have helped the RPs to be better prepared for the character assets available and standard of engagement options provided as part of the virtual scenario the RPs encountered in the VRLE (Stepanova et al. 2019). Hunt and Falconer (2019) suggest that words such as *extended* or *potential* reality should be considered for use as an indicator of the experience offered within VRLEs.

6.3.9.2 Post-action

RPs were asked whether they felt using the VRLE had a positive or negative impact on their learning or no impact at all. A positive impact was noted by 85.8% (n=217) of RPs post-use compared to 91.6% (n=285) who had expected a positive impact pre-use. No impact was noted by 13.8% (n=35) compared to 6.4% (n=20) who stated they expected this pre-VRLE use and finally 0.8% (n=2) claimed they had experienced a negative impact which was the same as pre-use when 0.6% (n=2) had expected this. This is clearer when viewed in the crosstabulation Figure 33 below.

			Time Pre	Time Post	Total
Please rate your belief that use of Virtual Reality Learning Environments (VRLE) have an impact with your learning?	Positive impact	Count	282	217	499
		% within Time	93.1%	85.8%	89.7%
	No impact	Count	19	34	53
		% within Time	6.3%	13.4%	9.5%
	Negative impact	Count	2	2	4
		% within Time	0.7%	0.8%	0.7%
Total		Count	303	253	556
		% within Time	100.0%	100.0%	100.0%

*(Table title above: **Please rate your belief that use of Virtual Reality Learning Environments (VRLE) have an impact with your learning.**)*

Figure 33 - Crosstabulation of RPs' belief of VRLE impact on learning.

Interestingly, from this data it can be seen that there was a negligible difference of 1% for those who perceived VRLE to have a negative impact, though the belief it has a positive impact on learning decreased by 8%, whilst those who believed it had no impact on learning increased by 7%.

Presented as a chi-square test again (Figure 34 below) shows there is no differential ratio in the pre- and post-action responses [pre .016, post .016].

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.283[a]	2	.016
Likelihood Ratio	8.292	2	.016
Linear-by-Linear Association	6.778	1	.009
N of Valid Cases	556		

Figure 34 Chi-square test results related to whether RPs believed VRLE would impact on their learning.

There was a 95% CI of 1.08 pre-action and 1.15 post- action [.130, .019] (Figure 35), the standard error difference was .28 and the p-value was 0.009.
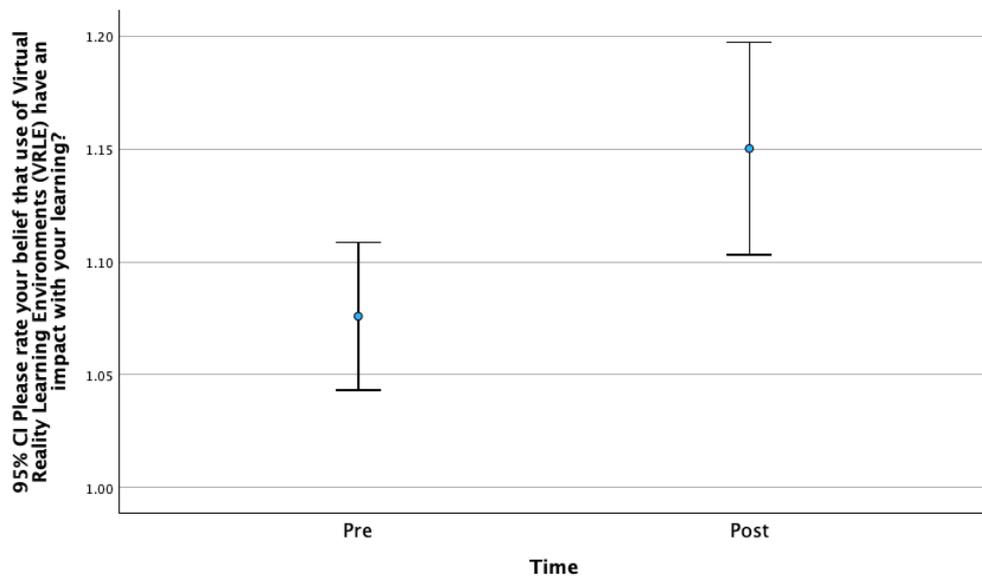

Figure 35 - RPs' belief that VRLE can impact on learning.

Overall, it can be concluded from the analysis of this question that that there were fewer RPs satisfied with the VRLE impact on their learning post-action. This result is perplexing when compared to the outcomes for questions relating to whether RPs believed the VRLE had an impact on their confidence in clinical skills, confidence in clinical skills specific to safeguarding, impact on bridging the theory – practice gap and impact on clinical intuition which all demonstrated that the RPs believed the VRLE supported them to do this. Presumptively it could be argued that although the VRLE has supported learning and clinical practice, the RPs do not feel emotionally satisfied with learning and clinical practice in VRLE. However, this will be explored further in the analysis of the qualitative data for each theme in Chapter Seven.

6.3.10 Belief that use of VRLE will impact on patient safety.

6.3.10.1 Pre-action
RPs were asked:

Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an associated impact on patient safety.

The purpose of including this question was to help assess the VRLE experience in relation to research question two which explores humanisation of care within VRLE. Interestingly, despite concerns voiced in the responses to the previous question by some respondents that VRLE might have a negative impact, none of the 304

respondents chose that option for this question. Instead, 86.2% (n=268) felt it would have a positive impact and 11.6% (n=36) felt it would have no impact.

The RPs who left additional information indicated that, although they were uncertain what to expect during their learning experience, they placed importance on holistic and humanised care.

This RP points out the individuality of each episode of healthcare and that this can impact on patient safety.

> *"This is because each situation is different and can result in different consequence so it's important to take this into consideration to ensure patient safety."*
> (QID 6432, L.249)

While this one raises concern over whether confidentiality can be maintained in the VRLE.

> *"Unsure of confidentiality and what's it like to use VRLE."*
> (QID 8786, L.251)

Of equal importance is the need to consider each person holistically when planning healthcare as highlighted by this RP.

> *"Again some impact but this depends on the patient comorbidities."*
> (QID 2834, L.255)

6.3.10.2 Post-action

The RPs were asked to consider whether they felt their use of VRLE had an associated onward impact on patient safety and 85% (n=215) felt that there had been a positive impact compared to 86.2% (n=268) pre-use, 14.6% (n=37) had felt there was no impact compared to the previous 11.6% (n=36) and 1.2% (n=3) considered there may have been a negative onward impact.

After SPSS analysis, as depicted in the chi-square in Figure 36 below, there was no significantly measurable change in RPs' belief pre- and post-action.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.289[a]	2	.117
Likelihood Ratio	5.420	2	.067
Linear-by-Linear Association	2.235	1	.135
N of Valid Cases	552		

Figure 36 - Chi-square test results related to whether RPs believed VRLE would impact on patient safety.

There was a 95% CI of 1.12 pre-action and 1.16 post- action [.106, .014] (Figure 37), the standard error difference was .031 and the p-value was 0.135.
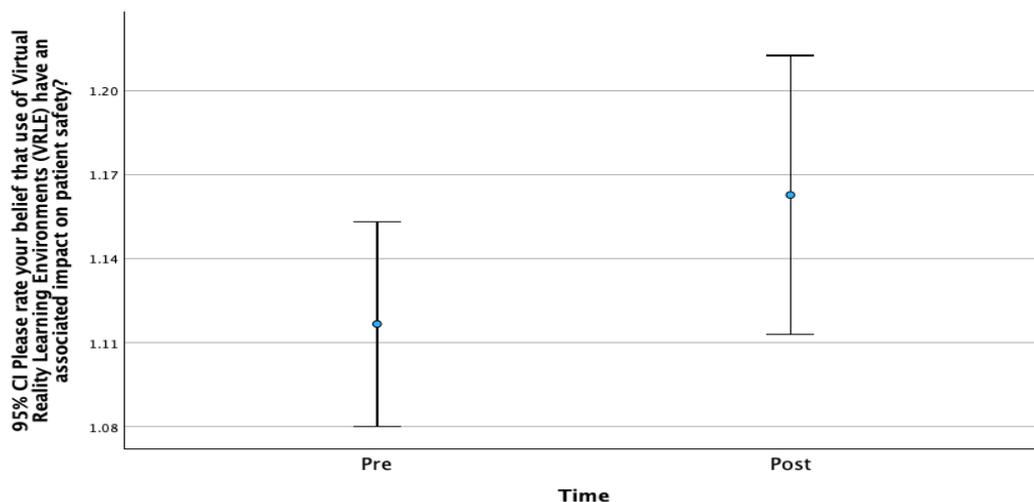
Figure 37 - CI of RPs' belief that VRLE can impact on patient safety.

Therefore, it can be concluded that RPs felt that VRLE could have an associated onward positive impact on patient safety, a factor which is irrevocably linked to provision of high standard healthcare. These preliminary findings indicate that the VLRE could support safe fail practice and help VRLE users to meet the standards detailed in the NHS Patient Safety Strategy (NHS England 2021) which include the expectation that lessons are learned from adverse events. This transferability of learning will be explored further within the qualitative data in theme three (section 7.6.3.3) of Chapter Seven and woven through the discussion in Chapter Eight.

6.3.11 Expectations of time commitment

6.3.11.1 Pre-action
RPs were asked:

How many times do you expect to use the VRLE?

Over half of RPs 55.6% (n=173) felt they would use it 1-3 times, 33.1% (n=103) thought they would use it 4-5 times and with just 11.3% (n=35) expecting to use it 6 or more times.

6.3.11.2 Post-action
RPs were asked how many times they had used the VRLE and for how long, with 1-3 times being the most common response at 83% (n=210) which was an increase on the pre-action presumption where just over 55% (n=173) had expected this. Slightly more frequent use of 4-5 times was reported by 15.4% (n=39) which is half the amount pre-action and 1.6% (n=4) used it 6 or more times which again was fewer than pre-action.

Figure 38 below shows the difference in expectation of usage pre-action in the top half of graph compared to the amount of usage reported post-action can be seen in the bottom half of the graph.
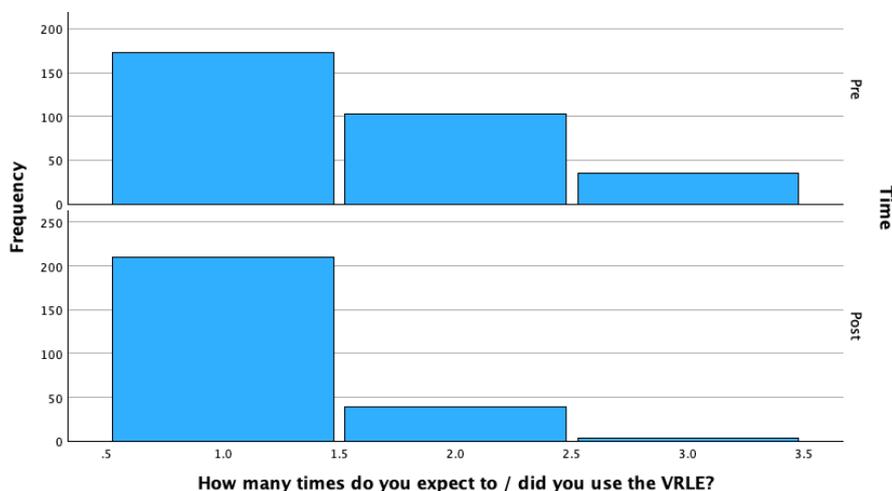
Figure 38 - RPs' expected and actual use of VRLE.

Most RPs reported that they had used it between 10-30 minutes 71.6% (n=181). The text comments left by RPs explain some reasons for this time variance.

The VRLE impacted on their battery capacity.

> *"Drains battery of phone very fast and makes it very hot."*
> (QID 3364, L.318)

The VRLE caused nausea after a while.

> *"Made me feel a little bit sick if I did it too much."*
> (QID 3686, L.321)

In addition to working through the scenario the VRLE environments family homes could be explored, inside and outside. This may have added to the time the RPs spent using the VRLE.

> *"I explored around the house and had a look around as well as talking to the people in the house."*
> (QID 2426, L.322)

These responses link to research question three which explores the impact of VRLE functionality on the RPs experience and ability to engage with the scenario. It is interesting that the RPs' used the VRLE fewer times than they had expected to do pre-action. However, it is not clear from the quantitative date whether they had used the VRLE for fewer times because they wished to do so or because they experienced functionality issues which necessitated this. This will be explored further in theme four (section 7.6.4) in Chapter Seven.

6.3.1.2 Interest in using more VRLE
RPs were asked:
Would you like to use more Virtual Reality Learning Environments (VRLE) for learning / practicing skills?

Now that the RPs had experienced the VRLE, they were asked whether they would like to continue learning and practising clinical skills in this way. The respondents answered this question positively overall with 84.2% (n=213) saying yes, 11.5% (29) did not want to use this form of learning again and 4.3% (11) chose a neutral answer. This is an intriguing distribution after the RPs feedback in 6.3.9 that the VRLE had contributed to increasing their learning and skill practice opportunities but not their satisfaction. This desire for more VRLE is explored further in Chapter Seven when the impact of VRLE functionality is shared by the RPs as well as discussed in Chapter Eight when considering the types of VRLE the RPs have suggested.

Student engagement with the learning environment is known to impact on learning outcomes (Wang and Ji 2021) and the negative responses raised further questions in relation to why those RPs would not want to use additional VRLE. Although the RPs who answered negatively or neutrally to this question are a relatively small number, the reasons why they did so are important in contributing to decision making about whether they would feel more positive if they had the option of engaging with VRLE in a

different way. For example, they might prefer to use the VRLE at the same time as members of the multidisciplinary team (synchronous use) so they experience and work through the scenario together. Stroud et al. (2017) feel this synchronous learning aids in development of emotional intelligence and other aspects which are important for patient safety. However, Gallup et al. (2019) suggest that the influence of social learning factors is less impactful within the virtual environment than out of it.

Open text responses reflected the broadband issues that the first cohort of RPs had experienced when downloading and entering the VRLE on University campus. The method for supporting RPs to download and use the VRLE was changed as a result of reflecting on their negative experience and the research concept process was revised so that they were instead supported to do this off campus where there was less broadband traffic, however accessing the VRLE whilst on campus was also an option. There were respondents who reported having experienced additional technical and other unspecified difficulties. The qualitative data collection supported further exploration of this aspect throughout each theme and in relation to generating answers to research question three. This provided depth, added clarity and will be discussed further in Chapter Seven along with consideration of a branched VRLE (phase one branch) that grew from this action research and requests for others.

6.4 Discussion

6.4.1 Relevance of findings to research question one

What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?

Research question one focused on the impact of VRLE use on RPs' self-perceived use of intuitive practice and humanisation of care. The quantitative data shows that a statistically significant number of RPs felt that learning in the VRLE had a positive benefit in respect of their ability to practice use of their clinical intuition (gut instinct).

The data has shown that there was a notable increase in RPs' confidence after use of the VRLE. The quantitative responses have demonstrated that overall, the RPs found the VRLE beneficial for practicing clinical skills in general. There was also an overall increase in reported confidence in skills specific for safeguarding. The majority of RPs also stated that they would be keen to continue to use VRLE for this purpose.

There was no change in the significantly high percentage of RPs who believed the VRLE helped bridge the theory and practice gap which confirms previous research

findings for using VR for this aspect of learning (Cooper et al. 2017). This also further supports the premise of using VRLE to offer learning experiences which cannot otherwise be guaranteed and adds to the value of VR in helping learners to develop their confidence in their clinical skills. As discussed earlier in this chapter an increase in confidence is thought to support and increase use of clinical intuition.

Clinical intuition is a skill that healthcare professionals can utilise as part of their holistic care (Jackson 2022). It is a component of many healthcare professionals' clinical practice, it is present proportionate to learner's knowledge and confidence, and believed to be a skill which can be taught (Witterman et al. 2012; Phillips 2013; Melin-Johansson et al. 2017). Clinical intuition can support healthcare professionals to pick up on nuances which may not be voiced but are vital to recognise in order to deliver individualised care – for example, when there are issues being experienced such as child abuse, domestic abuse or intimate partner violence (Ling and Luker 2000; Koistinen and Holma 2015; Horwood et al. 2018). This quantitative data has shown that nearly all of the healthcare students who participated in this research believed that VRLE offered opportunities to learn and practice their clinical intuition and there was negligible difference measured in RPs belief pre- and post-action.

6.4.2 Relevance of findings to research question two
To what extent does healthcare students use of VRLE relate to the humanisation of their healthcare?

Research question two explored the extent healthcare students' use of VRLE related to changes in the humanisation of their healthcare and their perception of the subsequent impact on patient safety. Learning the importance of person-centred care and being able to practice skills for prioritising people will ensure that humanisation of healthcare remains a key priority of clinical care (NMC 2023b; NMC 2023f; WHO 2019). The 6 Cs of effective healthcare (Cummings 2012) are pivotal in humanising healthcare provision. Once adjustments had been made for difference in sample sizes, the data showed that over 3/4 of respondents felt that VRLE supported them to practice the humanisation of their healthcare skills. Despite that, some RPs felt that the VRLE was not a replica of real-life clinical interactions and that this may have limited their perception of their ability to humanise their healthcare. Slater et al. (2019) suggest that VR is fast becoming a product of evolution and as a result is developing its own expectations of behaviour.

It can be seen that behaviour and standards of conduct within VR is important even if people may not behave in quite the same way as they would outside of VR. It can be argued that this in itself is also important as it allows healthcare students to learn from experiencing clinical safe fails in various aspects of healthcare from routine procedures to emergency situations. This in turn not only protects people from errors in care but also the frontline healthcare workers themselves from dangerous situations which may be unfamiliar if not experienced and learned from in VR before exposure in real life, such as the safeguarding experiences offered in the VRLE for this research (European Aviation Safety Agency 2012; NMC 2018c; Vosper et al. 2018; WHO 2019).

However, when asked if the VRLE had helped them learn something new, although the positive responses remained high, this was a slightly smaller positive response compared to the perceived benefit for using VRLE for practising clinical skills pre-action. When reading the open text comments in an attempt to gain clarification, it appears to be that the VRLE was appreciated as a place to practice existing skills, to view aspects of clinical care in a different way or to have their learning experience seem "more real" even when it did not teach them something new. There was some concern expressed that VRLE could be used to completely replace traditional face to face teaching methods which has highlighted the need to be transparent about the VRLE being intended as an adjunct to learning in the classroom or clinical placement area.

Student perception of their conduct related to patient safety is a valid and important aspect to be explored in relation to research questions one and two. It could be argued that self-perceived confidence levels will be translatable to performance of clinical skills and care giving thereby impacting on patient safety. Previous research findings show that confidence is paramount to the improvement of patient care because confident practice is irrevocably linked to effective clinical decision making (Hecimovich and Volet 2009; Peterwerth et al. 2022). The data for this research did not change between pre- and post-action and demonstrates that RPs overall felt that VRLE use can have a positive onward impact on the patient safety.

6.4.3 Relevance of findings to research question three
To what extent does the VRLE functionality impact healthcare students'

perception of their ability to engage with the given scenario?

Research question three focused on exploring the functionality of the VRLE in relation to the impact on the RPs' experience. In the UK 77% of households have internet but

the broadband connectivity does vary and is dependent on demand, location and other factors (Hutton and Baker 2019). Some RPs reported broadband and capacity issues as well as dissatisfaction with how long it sometimes took to access the scenarios. Despite understandable frustrations at the technical glitches experienced by some RPs, the quantitative data appears to show that this has not had a detrimental impact on either the RPs acceptance of VRLE or on their belief in the value of using this as a learning tool as part of their educational package. It is not clear from the quantitative data whether the functionality negatively impacted on RPs' ability to engage with the scenarios, for example whether functionality issues pulled them out of their immersive experience. The analysis in relation to this research question will continue in the Qualitative Chapter (Seven) in order to gain contextual detail and generate a more comprehensive understanding of the impact of the functionality.

6.5 Chapter summary

This quantitative data has provided a foundation in response to the chosen research questions. The qualitative data will provide further clarity on how the VRLE has impacted on their use of clinical intuition, humanisation of their healthcare and allow for richer interpretation of the RPs experience of learning within the VRLE. The combination of analysis of these data collections will be discussed in Chapter Eight and will allow for holistic conclusions to be drawn and recommendations to be made.

Chapter Seven: Qualitative data collection and analysis

"Since ancient times, the human mind has performed a process similar to the one we are describing: it first located a group of stars in a sky filled with thousands and thousands of them, even gave them names like Pole Star, Aldebaran, etc. (categorisation), then it connected them with an imaginary line (structuring), and finally assigned it a new meaning (theorising) "it's a bear", "a lion", "a bull", etc. (Ballesteros and Mata-Benito 2018, p176).

7.1 Introduction

In the previous chapter the frame of analytic reference was the quantitative data. Some of the shorter open text contributions collected via the questionnaires were briefly considered in the quantitative data analysis (Chapter Six). This chapter will analyse and discuss the qualitative component of data for this research combined as their resultant themes and subthemes including the more detailed open text comments from the quantitative data collection. Qualitative data provided by the 31 focus group participants will be indicated by alphabet ID and line number, whilst the more detailed of the open text comments provided during the quantitative data collection will be included for analysis in this chapter and indicated by questionnaire ID [QID] and line number. As discussed in Chapter Four the more detailed open text comments from the quantitative data have been included in the qualitative data. As discussed in Chapter Four (section 4.5), this combination has enriched the data and facilitated robust data analysis. The thematic analysis is presented and discussed in this chapter and the thematic connectivity to the research questions is discussed in Chapter Eight.

7.2 Significance of final themes

There were four themes that arose related to the RPs experience of the VRLE further defined by subthemes for each theme as well as sub-subthemes for theme one. This section briefly details why they are important before the detailed analysis which follows (section 7.3).

1. Consideration of individual characters within the VRLE as a whole person
    a. RPs reported that during the immersive process of VRLE use that they at times found themselves giving consideration of individual characters within the VRLE as a whole person, including the role they played and members of the families. This is necessary for practising holistic care and for exploring safe boundaries in many aspects of healthcare such as lone working and maintaining vigilance in relation to personal safety.

2. Physiological manifestation of clinical intuition
    a. RPs reports of physiological response to the behaviour of characters in the VRLE included feelings of unease and that they could "trust their guts", feeling they could reason and problem-solve during the VRLE experience and consider how they might address challenging behaviour along with the acceptance of the potential risk posed to them as their avatar personification within the VRLE.

3. Identification with role

    a. RPs reported experiencing educational value from the VRLE as a space for practice opportunities including during theory / practice gaps. Provision of familiarisation with the clinical skills required during the VRLE healthcare episodes such as navigating challenging conversations and testing out skills knowing there would be only safe fails and no family members would come to harm.

4. Importance of functionality

    a. RPs difficulty with navigation, clarity of information, connectivity and burden on chosen mobile device through battery and storage demand.

Themes	Subthemes	Sub-subthemes
Consideration of individual characters within the VRLE as a whole person	• Holistic care • Safe boundary building	Compassion and empathy Care Competence Communication Commitment Courage
Physiological manifestation of clinical intuition	• Trust your guts • Sense of unease • New concept	
Identification with role / professional identity	• Familiarisation with skills required for challenging conversation and problem solving • Increased practice opportunities to bridge the theory-practice gap • Increased knowledge of how to conduct clinical practice though safe fails • Educational value	
Importance of functionality	• Battery and storage capacity • Connectivity and firewalls • Navigation challenges • Clarity of information	

Table 12 - Summary of themes, subthemes and sub-subthemes.

7.3 Thematic analysis

Theme one details feedback related to whether the RPs were collectively able to relate to the characters within the VRLE which, along with consideration of relevant literature, will be presented and discussed in question two. Theme two provides valuable insight in relation to question one which considers the possibility of clinical intuition being

present in VRLE as it would in a real-life clinical environment. Before the thematic connectivity to this question can be discussed, the concept of clinical intuition in relation to clinical practice and healthcare students' needs must be reflected on, which is done within theme two. For a VRLE to be of value to healthcare students and by proxy the universities they study in, it was important to understand whether the RPs felt the VRLE helped them to identify with their roles as student and future healthcare professionals. This is addressed in theme three and this theme will contribute to answering all the research questions. Finally theme four is formed of RPs collective thoughts about the VRLEs ease of access, useability, storage capacity and connectivity which will be analysed in this chapter before being discussed in relation answering research question three in combination with the knowledge gained from the qualitative analysis in Chapter Seven.

7.3.1 Theme one - Consideration of individual characters within the VRLE as a whole person

The RPs discussed how important this was to them that the complexity of people and the concept of person-centeredness was portrayed in the VRLE.

> *"I think the VRLE like really reflected how it's not just one thing that people have going on, there's multiple layers of things… that there's this whole world around these people so different stuff is probably happening so that's quite useful to experience before we went out in placement."*
> (V, L.37)

> *"…. really good to wander round the house and engage with the family who weren't really engaging, and you can see that from a safeguarding point of view as well compared to when we're on the road. And people do act exactly the same (in real life as in the VRLE)."* (Ph, L.181)

Other RPs commented on the scenarios' realism and how this could enhance learning and application to clinical practice.

> *"I agree with that when you see certain things it really helps with you know things about that whole idea of thinking and questioning and having doubts and concerns and that's what you need to be doing in a real-life situation."*
> (S, L.150)

> *"I felt I learned from the real-life scenarios and would find this easier to remember in practice."*
> (F, L.189)

However, there were others who wished the scenarios could be manipulated by themselves in order to make the experience more realistic.

> *"It was good, I suppose the only thing was the limitations of the scenarios because it was actually practice but it was very useful. Maybe if the patient had different reaction the answers you gave them it would make it a bit more changeable shall we say more like real life essentially…."*
> (A, L.165)

This aspect is explored further in section 7.6.3.1 where RPs discuss the restrictions within the VRLE limiting the degree to which they could individualise their autonomous clinical practice.

Despite the lack of flexibility within the scenarios, the RPs experienced emotional responses in relation to aspects of the VRLE scenarios and discussed the value this can bring to their performance in clinical practice placements.

> *"I was quite shocked when I first walked in and I saw baby Evie was sleeping with some random man on the couch. I think that's the thing that's good about virtual reality because if that was my first experience and it actually happened in real life I think I'd have to like just take a moment because it's quite shocking."*
> (P, L.157)

This is in line with research conducted by Suzuki et al. (2013) which demonstrated that within fully immersive VR the scenario could be enhanced to stimulate alteration of the perceptions of the user and also to produce an emotional response to the scenario they were exposed to. Lanier (2016) is in full agreement with this and goes on to suggest that VR is a good platform for supporting exploration of cognition and perception in relation to what makes us human.

RPs also highlighted that use of the VRLE could facilitate making connections between the known and unknown which has a part to play in recognising individuals as whole people in order to determine what might be needed for provision of holistic healthcare.

> *"I thought that the parents might have given Evie alcohol to get her to go to sleep because they were saying how much she was crying the night before."*
> **note: there were numerous empty alcohol bottles visible in the kitchen**
> (Jo, L.159)

Humanisation of healthcare is considered to be an integral aspect of holistic care (Curtin et al. 2020). Additionally, Bass et al. (2018) stress the importance of including humanisation of care in healthcare pedagogy as part of our responsibility to students. Therefore, it is important to determine what impact VRLE have on RPs ability to incorporate humanisation into their healthcare provision. As established in Chapter

One, healthcare is a collaboration between the healthcare worker, the person needing the healthcare and any relevant professionals from the wider healthcare team which is patient-centered care (Oates et al. 2000; Sabee et al. 2015). For this to be at its most effective the person needing care should have this addressed in relation to their needs as a whole person which, as discussed in Chapter One, is person-centered care (Ekamn et al. 2011; Olsson et al. 2013). Person-centred care facilitates the provision of holistic healthcare which is the topic of the next subtheme.

The subtheme of holistic care is further defined by sub-subthemes in order to showcase its resonance with the ethos of the 6Cs. The holistic care theme, sub-subtheme and safe boundary building theme were generated because the RPs reacted to the scenario avatars as whole people with layers to their lives with human needs and urges. The central focus of this section of the discussion will be in relation to the RPs' demonstration that they believed the VRLE supported them to experience the feelings necessary to holistically develop these skills. The aspects where they felt the VRLE could be improved to increase their potential for holistic care and abilities to build and maintain safe boundaries will also be discussed.

7.3.1.1 Subtheme - Holistic care
RPs commented on the VRLE being a space where they could experience aspects of holistic care before having to do this out in the clinical placements in order to provide care in a more confident way.

> "I did actually think it was really useful to do like before going out …umm before going out on community placement especially where obviously we're going to people's houses and things so kind of it was good to see how you should react to people in their own homes."
> (H, L.19)

Another RP said that it offered them a place to react in a genuine and transparent way which they then could reflect on. By doing this they believed they could identify aspects where they would need to modify their reactions in order to support families more effectively.

> "…all those kinds of quite shocking things…. they could really floor you actually, the first time you experience it…and actually that's quite overwhelming and a shock factor if you haven't experienced that before and you really don't want your face to be obviously like oh my word, what's happening …so I found it quite helpful in terms of that…"
> (R, L.75)

The RPs discussed how the VRLE facilitated resonance with the scenario avatars which caused them to feel empathy and compassion for the scenario characters and to care about the current family dynamics. Care and compassion are two of 6Cs of healthcare (Cummings 2012), these and the other 6 Cs will be discussed individually within this subtheme of holistic care.

7.3.1.1a Sub-sub theme - Compassion and Empathy

RPs expressed their wish to be able to practice empathetic healthcare in order to present themselves during clinical practice in a non-judgemental and compassionate way. This RP shared concerns about how to appear empathetic without prior experience of a particular situation.

> *"I think that you want to be able to almost have the situation to practice on if that makes sense without it being real so you don't come across as unprofessional because for them that's their norm."*
> (B, L.83)

Compassion has been described as intelligent or therapeutic kindness and is one of the 6Cs which are considered to be core components of gold standard healthcare (Cummings 2012). Compassion is key to emotional investment in the wellbeing of others and a close cousin of, as well as inherently linked to, empathy which gives rise to the desire to help others (McCall and Singer 2013).

Their concerns about this are linked to desire to deliver healthcare in person-centred ways and they felt the VRLE helped with this. The RP below demonstrated the healthcare students' awareness that there are external influences on individual's behaviours.

> *"I found that the VRLE was really helpful for seeing the wider family picture. It's hard to describe that in a scenario!"*
> (RC, L.194)

Empathy is defined as the ability to feel the same emotion as another being without it being our own personal experience, instead it is an observed experience and forms part of how healthcare is delivered in a compassionate way (Singer and Lamm 2009). Empathy is a clinical skill that requires awareness of self and others as well as clinical intuition though researchers argue that empathy should be used as a form of clinical concern which they liken to compassionate healthcare giving (Decety and Cowell 2015; Decety 2020). Thusly in the complex context of holistic healthcare compassion can be defined as a rational response to empathy, giving rise to concern and a desire to

provide affective individualised care for people (Jeffrey 2016; Dohrenwend 2018; Hodgkins 2022). In short, feeling empathy will lead to compassionate actions.

RPs discussed the ways that they believed the VRLE supported them to experience empathy.

> *"You think yeah there are no parents in this house…why is this child at home…why are they not dressed properly…"*
> (R, L.77)

RPs also felts that use of the VRLE supported them to recognise that these empathetic feelings should be used to help the other characters, but also that this offer of help needed to be considered in balance to the risk this could pose.

> *"We couldn't really have a conversation with the mother because she might have to say something private and there were two men in the house."*
> (M, L.158)

When an empathic response occurs but a rational consideration can still take place this is known as multidimensional empathy and is important in safe provision of healthcare, particularly when there are safeguarding considerations to be made (Hodgkins 2022). The shortened quote from the RP below (full quote in Appendix 7) is an example of how practice time in the VRLE supported them to work through the contrast between what they were being told by the parents, what they were seeing in the houses, how these comparisons made them feel and how it impacted on their decision making.

> *"…seeing a family (the Melser VRLE) where the telly is on during the day and the house isn't safe or you don't really know whose coming through or a very pretty house (the Parvell VRLE) with no toys no child friendly things…yano [sic] you can say freestyle parenting but if there's nothing for your child to engage with then you're not parenting, that's neglect…"*
> (R, L.110)

Conversely, the RPs felt that the virtual environment had limitations which prevented them from fully demonstrating their empathy.

> *"…how could we possibly demonstrate a great deal of compassion and empathy through a virtual reality environment…?"*
> (Ph., L173)

Decety (2015) states that empathy gives rise to the desire to help others. Emotions have a profound impact on experiences and on the way healthcare professionals behave and react in any given healthcare episode (Pickens 2005; Walsh 2009).

This led them to question whether use of the VRLE might cause them to demonstrate inadvertent lack of empathy when having to rely on reading text to decide on next steps in offering healthcare.

> *"I think you can get the wrong end of the stick through typed words. You have to hear the tone of the person's voice…"*
> (Hi, L174)

The RPs felt that although the VRLE did not offer options to vary depth of demonstration of empathy, such as through verbal conversation as highlighted by the RP above, it was still of benefit for practising these skills or finding out more about situations.

> *"…overall we don't have the resources to practice these skills as much as we'd like to so I think that the idea of having virtual reality where you could just practice and practice where you don't have the resources or an actual person is a good idea."*
> (O, L.175)

> *"I found it helpful to just be able to see more of the situation. Normally safeguarding situations are described or written. It's much easier to observe interactions between people or watch how they interact with their environment and how it changes when others come in. This was enhanced using the VRLE."*
> (QID 8108 / L.349)

It is clear that the RPs believe that being an empathetic individual is a desirable behaviour particularly for anyone learning and working in healthcare. Therefore, as Catling (2018) argues, education about this skill should be enhanced during healthcare education in order to maximise healthcare students' ability to provide empathetic healthcare. Hodgkins (2022) agrees and emphasises that this is an important aspect of developing professional identity, particularly when caring for children and their families. Previous research has concluded that use of VR in a pedagogic way to elicit empathetic behaviours in healthcare is appropriate and effective, however those studies have used qualified healthcare professionals as the RPs rather than healthcare students (Brydon et al. 2021).

Overall, the RPs demonstrated that they considered that the VRLE had helped them to have an empathetic learning experience:

> *"I think it is a good way of demonstrating what it is like to be in someone else's shoes."*
> (N, L.190)

> *"It was helpful to be able to see how to engage with the family and address issues without causing offence."*
> (QID 4322 / L.296)

Fields et al. (2011) described empathy as a cognitive characteristic and that to be empathetic one must not only understand the experience of another but also be able to communicate this understanding effectively in order to declare their desire to help the other. This could lead one to assume that if empathy is a cognitive attribute than empathy must be a learned skill. However, Hojat et al. (2009) argue that whilst there are clear links between empathy and clinical competence, the evidence to support empathy as a learned skill rather than an emotional characteristic needs further exploration. The findings from this research demonstrate that the RPs' believe the VRLE can support them to provide healthcare that is more empathetic.

Research by Ward et al. (2018), which focussed specifically on eliciting culturally empathetic responses, did use healthcare students as the RPs and concluded that VR could be used to improve cultural empathy in healthcare. However, they experienced the VR simulation in the role of the patient rather than as the healthcare student and the research outcome may have been different if the roles the RP experienced were also different. Whereas, with my research, the RPs' were able to use the VRLE in their role as a healthcare giver and their feedback shows that they believe this was helpful to them.

It can be seen that overall, the RPs expressed satisfaction at having a space in which to practice their clinical skills without any risk to real life health service recipients, which further demonstrates their desire to humanise their healthcare. This desire for risk reduction will be discussed in the safe fails section (7.6.3.3). Compassion, one of the 6 Cs of gold standard healthcare, was discussed above as part of empathetic healthcare. Next, the RPs collective opinion on how the VRLE facilitated practice of care will be discussed.

7.3.1.1b Sub-sub theme - Care
The act of giving care is an important component of humanisation of our actions in healthcare (Fasanelli et al. 2017). The RPs demonstrated their desire to humanise their

care as they discussed in detail concerns they had about ways in which they might react negatively to living conditions of homes they would enter as part of their episodes of care giving.

> *"If you're personally confronted with a situation how would you possibly react? And having this vrle it does open your eyes as well because I was a bit naïve to think it shouldn't really happen in England and yano why does this still happen in any country really?"*
> (B, L.83)

RPs also offered insight into how the VRLE could support them to learn how to provide equitable healthcare for people in home environments that were less than optimum living conditions or made them feel uncomfortable.

> *"It was first timer [sic] using VRLE and before I was a bit sceptical and did not think it would teach be anything or be useful however, it taught me to not be afraid to ask questions as long as they are still professional after all we have a duty to safeguard."*
> (QID 0199 / L.348)

The RPs also discussed ways in which the VRLE supported them to reflect on their care in past and future clinical practice.

> *"I don't think it was new things that I learned but it definitely made me view it differently."*
> (QID 8108 / L.298)

> *"I think as paramedics to be fair we do get stuck on the patient in the house and don't really tend to take a great insight on the surroundings that we're in m we're all quite blinded when we do go into the patients house and we do just kind of focus, don't really take a great insight into what's probably going on in the house so I think we probably miss quite a bit, with that virtual tool I think it will definitely help with the paramedics."*
> (P, L.187)

Research supports the value of using reflection about clinical practice in order to improve humanisation of care which supports changing individual's practice so they can value themselves as well as those they care for and those they work with (Todres et al. 2009; Rees 2013). Reflection contributes to developing clinical competence (Watts et al. 2021) and these findings indicate that VRLE could be used as a space where healthcare students could immerse in reflection about clinical practice as individuals or in groups.

7.3.1.1c Sub-sub theme - Competence

Competence is important in healthcare, not only in respect of being able to provide safe care, but also in ensuring that the care is perceived to be humanised (Busch 2019). Healthcare students must demonstrate competence in healthcare on an ongoing basis throughout their degree as they progress through achieving the required proficiencies. The RPs felt that the VRLE supported them to work through different ways to do this in their journey to becoming autonomous practitioners.

> *"I'm glad you highlighted the different opinions of the clinical staff about the ambulance for the 14-day old baby. This helps to show that safeguarding is VERY subjective and that we have to do the best we can with the information available."*
> (RC, L.194)

As discussed, the VRLE mimicked real life to the extent that RPs were able to feel strong emotions about the characters within the learning experience. This reaction outside of the VRLE would necessitate practice of varying amounts, until a healthcare student could work out how to deal with any clinical situation in the most appropriate manner, to maximise the humanisation of the episode of care.

Practice opportunities are limitless within the VRLE, whereas in the physical world there would be only one chance per episode of healthcare with an individual family to get clinical behaviour right. The RPs feedback how important this was to them to be able to have opportunities to apply theory to clinical practice.

> *"It reinforces and revises learning from practice so it would be useful as update training alongside core skills."*
> (QID 6350 / L.300)

This finding is not new as Power (2014) highlighted the importance of healthcare students feeling supported to practice clinical skills without rapprochement until they feel personally competent. However, the RPs' feedback shows that they value VRLE as a new way for them to be able to apply theory to clinical practice whenever they wish to in order to progress as individual learners.

7.3.1.1e Sub-sub theme - Communication

RPs echoed the concerns of healthcare students in clinical practice saying that figuring out how to communicate in ways appropriate for each situation is on ongoing challenge for them.

> *"I think even if we were in practice there are issues that don't come up very often I mean it's not very often in hospital that you see somebody that you need to correct their behaviours like the safe sleeping. You explain it but you don't*

often have to correct it because you don't see it very often so when you do it can be difficult to know how best to approach it so when you have that example of how she (the clinician) approached it in the vrle I think that was really helpful."
(Hi, L.153)

RPs discussed how the VRLE was of use to figure out how to ask questions in a way that would encourage people to respond.

"I think for someone like me it kind of helps for when I am in a situation I struggle with like exactly what I should be asking and how I should be wording and things like how to approach especially subjects such as safeguarding how should I be asking the questions about coming across in a way you wouldn't want it to come across as so I feel like it kind of helped in that sense and in what way can you ask."
(S, L.131)

RPs felt that the VRLE offered them a space to explore different ways of communicating information in given situations. And making ongoing choices that arise from these conversations.

"Different practitioners do react in different ways and I think that within…I can't remember my exact choices within the app that I made but you could definitely see that there were choices and that they were different ways of perhaps handling the situations…"
(C, L.86)

The quotes below not only demonstrate the perceived benefits of practising communication in the VRLE but also the desire of the RP to ensure they are humanising their healthcare.

"I think it also highlights because you know you're ticking who you want to indicate what safeguarding for and it's not just for abuse and it highlights all that safeguarding is for and then when bringing up the conversation of safeguarding with families makes it easier because it's not just saying I think you're causing risk to your child it might be instead that I think you might need a bit of help in this category and it nicer for the taboo subject and it's like then I'm not saying safeguarding is something wrong but just that you might need some help."
(Y, L.145)

"What I've learned from the VRLE is that actually you can ask those awkward questions and actually they're not awkward and they are there for safety, for a reason, so you should have the confidence to actually approach it and I think now if I actually went to something which is similar where I do have a clinical concern and where I think safeguarding concern I'd like to think that I now do have the knowledge to say why do you live like this, what is going on, what else is going on for you to live like this?"
(T, L.146)

Students learn at different rates and this lends support to the argument that there is a need for healthcare students to have affordable and accessible places to practice communication and other clinical skills required to humanise their healthcare as often as they need to (Johnson et al. 2020).

> *"I really enjoyed that the vrle wasn't black and white, there was a lot about perception and probing and keeping yourself as safe as possible when weighing up who needs what. This is MUCH more close to real life than simple instructions as to what to do next."*
> (E, L.195)

This aligns with Rushton et al. (2020) who suggest that offering healthcare students a virtual environment to practice facilitates development of crucial skills such as communication because it emulates real life clinical practice.

7.3.1.1f Sub-sub theme - Commitment

RPs discussed their belief that the VRLE allowed them to be committed to their education because it would allow them to access clinical experiences to practice and learn from as and when they wished to engage with them.

This included being able to learn in a different way that suited them as individuals.

> *"I'm a practical learner. I find it really difficult to focus and absorb things from a powerpoint so ummm being able to ahhh practically learn those skills in the vrle was ummm ahhh it was really beneficial to me I think because I learnt ahh what I need to be doing in practice rather than all of the information behind it. I know it is important to know all of that and I know and yeah I do learning in my own way all of those things as well but the VRLE sort of solidified it and I was able to sort of put it all into practice."*
> (M, L.135)

Or to use as a supplement to the in-classroom teaching or to engage with skills already experienced while in clinical practice.

> *"I was gonna say that I liked using it because it was different and like everyone kind of said it wasn't just like using a powerpoint and I don't mind using a powerpoint and learning from it because I feel it kind of gave the basics so when we did go into learning through the VRLE you already have some kind of understanding of you know your gut instincts and what you would do in those situations and it gives you that practice before you go back out into practice and just to kind of learn from it."*
> (S, L.138)

Furthermore, the RPs felt that the VRLE gave them a place to work through what they could expect from a planned healthcare episode.

> *"I was still surprised to see how difficult the situation was which I think in hindsight could reflect on how…. I think the virtual room helps people to visualise it in a much better way."*
> (B, L.89)

Of equal importance was the desire to understand what other healthcare workers' roles would be during an impending meeting while out in clinical placement.

> *"Useful out in community as well because I have had a safeguarding meeting and seeing how everyone does interact in real life it was quite nice to see that there was all those options as well beforehand rather than going there wondering oh my gosh who are all these people? Instead it's oh, I've read about you!…. and it was nice in the VRLE to click on who I thought they should be referred to as well."*
> (H, L.71)

Riley et al. (2019) warn that levels of stress during clinical experiences will impact students' commitment to their chosen professional educational journey. Conversely, Teekens at al. (2021) suggest that if healthcare students feel a part of the clinical team, they are more likely to remain committed to their education and more resilient to occupational stressors. Therefore, it can be argued that healthcare educators, whether academic or clinically based, have a duty to ensure healthcare students are exposed to forms of controlled clinical simulation and are well placed to do this as healthcare educations are themselves registered professionals within their chosen healthcare discipline (McCarthy et al. 2018; Holmes et al. 2020).

Interestingly, one RP expressed their belief that VRLE could benefit physiotherapy patients further demonstrating their commitment to improving the wellbeing of those they care for by considering another way they could humanise their healthcare provision.

> *"I've heard quite a lot of times…that patients from neurological wards or strokes wards or brain injury wards that they feel as if as soon as they've had their like first bought of rehabs they're sort of just dumped by themselves, they're left by themselves and the rehab stops. Ummm so I think VR has a really big place, especially for neuro patients so they can have repetition in the rehabilitation so it keeps going on and for MSK outpatient therapy as well VR would be really beneficial."*
> (S, L.154)

This aligns research by Clements et al. (2016) who suggested that commitment is an important part of healthcare student's perception of their individual clinical practice, and the intensity of their commitment is impacted by the availability of clinical experiences. Additionally, it can also be seen that this research demonstrates the need to acknowledge the importance and value of students' perspective and their commitment to contributing to unique ways to humanise healthcare.

7.3.1.1g Sub-sub theme - Courage

Continuing with the 6 Cs, the RPs stated that their experience within the VRLE increased their courage in relation to experiencing similar situations when out in clinical practice.

> *"I think it's good to go on your first placement and with that foundation and not going in blind and not walk away going "oh my god I actually did not know this exists" or how do you sleep at night? Because otherwise you do walk away thinking "did we react properly?" I think yeah to have that sort of base there it does help yeah for sure."*
> (B, L.107)

Additionally, RPs explained that the VRLE offered a space where having the courage to ask questions could be practiced and why this would improve the healthcare they could then provide.

> *"I think it's good having those questions and doubts otherwise you'll leave wishing you had asked her in case you are causing their safety to be compromised and the VRLE puts you in a situation where you are not rushed and you have time to think about it and it's good to just take a minute to think and not feel rushed.*
> (S, L.150)

Confidence building was raised as an advantage offered by the VRLE.

> *"I thought to was good because it's a different take on learning and you're not sat in front of trying to learn off a power point all the time and it's actually in the environment and learning from clinical practice with something that builds your confidence and I've done a lot of safeguarding during my training and for me I felt a lot more confident in safeguarding environment but it helps you just pick up on those things."*
> (J, L133)

I feel that confidence is an adjunct to courage. The link between confidence and courage has been recognised since the 300s BC and it can be postulated that increased confidence will support healthcare students to deliver courageous care (Pury et al. 2007). These findings about courage and confidence building in VRLE also

aligns with more recent research which suggests that courage is considered by healthcare students to be an aspect which empowers them and ensures they have the resilience to provide excellent care in all clinical environments and to speak up if this is not the case (Hagg-Martinell et al. 2020; Pliskova et al. 2021).

Courage also straddles the need for safe boundary building within holistic care as effective healthcare cannot be provided if the person offering care is not safe or does not feel safe (Sadooghiasi et al. 2016).

7.3.1.2 Subtheme - Safe boundary building

Healthcare can be a stressful experience for people and this role can sometimes put healthcare staff at risk, particularly if the healthcare episode includes safeguarding families actions (Littlechild et al. 2016). Therefore, a necessary part of healthcare education is learning how to keep oneself safe as a primary aim, before the safety of persons needing healthcare can be ensured (Lamothe et al. 2018). RPs awareness of the need for learning how to establish the boundaries of their personal safety was evident from their discussion about how the VRLE helped them to test boundaries.

> *"I thought it was good at making you question and not taking people at face value which is something I am not very good at so you know people are slightly resistant to your questioning to make you ask or try a bit more and you know why aren't they sort of you know cooperating and letting you see the baby or something like that. I think I learnt a lot from that. "*
> (L, L.42)

The RPs also found the VRLE was helpful in showing boundary limits when they were not sure when to stop.

> *"… I think having the feedback as well…click an answer and it says like yeah that's fine or no don't push them that far is quite helpful to know as well."*
> (H, L.19)

The VRLE also seemed to help the RPs to work out why boundaries were in place at certain points of engagement with the VRLE scenarios characters.

> *"What I found tricky was answering…do you carry on the conversation or stop? I was like well surely you want to find out more but the answer is no you stop and I was like "really? Ok, so where do you go from here?" and of course you don't want to come across as being the authority because it's their home, their territory so it's almost like you have to just step back a bit to realise that you're coming into their home and you need to look at the view much wider, a wider picture than the tunnel vision."*
> (B, L.95)

These findings around boundaries are in line with research by Nielsen et al. (2020) which highlights the importance of understanding the flexibility of boundaries and argued that the ability to recognise when the situation changes, particularly if it begins to deteriorate, is a skill that can reduce stress and staff absences and ultimately could be lifesaving.

Clinical intuition can be impactful in alerting the person providing healthcare of risk to their safety as well as being of benefit to the person receiving healthcare. Theme two explores the RPs perceptions of using the VRLE to develop this skill.

7.3.2 Theme two – physiological manifestation of clinical intuition

The RPs discussed various ways in which they experienced physical reactions to aspects of the VRLE and the impact it had on their decision making. In healthcare this is often referred to as clinical intuition or gut instinct which relates to the physiological indications that there is more occurring with the person needing healthcare than is immediately apparent (Campbell and Angeli 2019).

> *"I feel like that's why using the vrle just gave me something umm just so I am a little bit more prepared and I don't go into a situation where I am completely stunned by it and I'll instead know that this is causing me to feel a bit alarmed and I can sense something's not right here and then be able to say to my mentor you know, I noticed this, to see if it's just me picking up on things or if she's seen it as well."*
> (S, L.144)

As the above RP indicated, clinical intuition is an important component of how healthcare decisions are made and communicated (Angeli and Campbell 2017). For this to be stimulated by the virtual clinical interaction it can be argued that there needs to be an element of realism to foster belief that the experience is true to life or a willingness of the learner to suspend disbelief to a certain degree. By this latter aspect I mean that they should not be asked to suspend disbelief completely otherwise they would be distracted by self-reasoning and rationalisation of the experience rather than benefitting from learning. For this to be successful the expectations need to be pre-loaded much as the intended learning outcomes (ILOs) are made clear to students at the start of a traditionally taught lesson or unit of learning.

There was a delicate balance to be had with informing RPs of the VRLE ILOs without giving too much detail of what they should expect to experience for fear of limiting their autonomous experience withing the VRLE. For this reason, the RPs did know in

advance that the VRLE had a safeguarding theme to it. Therefore, it should be acknowledged that they will have been on alert for concerning elements within the VRLE and may have been anticipating that their clinical intuition should be triggered by elements of the VRLEs. Due to this there were elements of concern of varying prominence embedded into the VRLE. This was built in as an attempt to more accurately explore the ability of the VRLE scenarios to trigger their clinical intuition, which has been highlighted as an important area for healthcare education to include to facilitate learning how to identify and understand their physiological responses to better prepare them for a career in healthcare (Beattie et al. 2018). The less obvious elements of the VRLE scenarios are also similar to real life practice where not all healthcare issues are outwardly measurable and sometimes are initially present as a physiological alert, as discussed in Chapter One, section 1.4.2 (Royal College of Nursing [RCN] 2019; Clark et al. 2021).

7.3.2.1 Subtheme - "Trust your guts"

The RPs' feedback highlights how important the experience of being able to test and practice their gut instinct within the VRLE was to them as healthcare students. RPs were surprised that they could experience sensations of clinical intuition within a VRLE.

> "I was surprised how my gut felt, how, how, I mean I go often from my gut I think "oh I don't like this" and in the VRLE I couldn't see anything obvious but even so something told me in my gut that something wasn't quite right and even in that virtual world I thought "oh my gosh" it still sort of works to trust your guts."
> (B, L.103)

The RPs felt the VRLE was useful in helping them to experience situations in the virtual space before they did in clinical practice and that in this way they could practice and gain confidence in their clinical intuition skills.

> "I did the gut instinct or alarm bells quite a lot and ehm it was like a oh yeah! I got that right like that was good."
> (V, L.25)

They discussed how the VRLE encouraged them to be proactive about alert to things that may be amiss.

> "The actual learning that you can pick up like the gut feeling and the ummm the alarm bell one was very helpful because it sort of made you look for things rather than just sort of work though it or wait till you get to the end."
> (P, L.164)

Others found that after using the VRLE their clinical intuition went into overdrive despite it being a skill that was new to them.

> "I found that it made me kind of question everything like if we couldn't get hold of a mom like she wasn't texting back or something like that it made me question everyone who wasn't answering the phone or getting back to us like why are they hiding?"
> (C, L.55)

These findings demonstrate that VRLE can support development of clinical intuition and as discussed in Chapter One it is a skill that has been recognised as a valid tool for determining clinical care needs beyond that which are easily observed or measured (Adam and Dempsey 2020; Erisman e al. 2020; Smith et al. 2021; Davison 2021). This research has shown that offering VRLE for healthcare students to use to practice and develop their clinical intuition skills recognises the importance of this skill.

Also important is the recognition of the fact that the ways in which healthcare workers experience intuition varies (Holm and Severinsson 2016). In the following subtheme the discussion focusses on the different ways that clinical intuition manifested for the majority of the RPs while they were experiencing the VRLE.

7.3.2.2 Subtheme - Sense of unease

Research by Martens et al. (2019) evidenced that VR environments can induce a physiologically and psychologically accurate response in the person experiencing the environment, this is confirmed by what emerged in this research. In the quotes below the RPs were referring to a moment when a new character entered the VRLE momentarily obscuring the clear path to the door as he walked through the front room to the settee with a long pause near the RP avatar while he has a conversation with his wife and brother-in-law. For some RPs this sense of unease manifested by making them want to move to a different place in the VRLE's living room.

> "I'm not comfortable and someone is now in that space between me and the door. I'm gonna move round the sofa. I'm getting into a different space now, I'm not comfortable here."
> (R, L.98)

Other RPs linked this sense of unease to be an emotional and physical demonstration of what they had already been taught in theory sessions. It was said to be a good learning experience to have this physiological prompt from their body to remind them what to do.

"There was one thing I completely forgot to say that there was one point in the one I visited where at one point you get blocked in a corner and that's one thing we're taught as paramedic to never get blocked into a corner and I'm guess that was in there in purpose to make you think about that, I really liked that bit so that was good because even though it was a virtual, it just didn't feel right and I was thinking oh I shouldn't be stood here yeah that was good!"
(T, L. 152)

While other RPs felt the experience in the VRLE went a step beyond unease to the point where it could be disturbing.

"I was going to say that on the app that when the uncle had first woken up the dad had come home and the mom was sat down with the baby and you were the only person left standing up so it was quite like a daunting experience. If that was real life and I was on my own I would find it quite scary. It makes you feel quite secluded and like the odd one out. It was quite intimidating."
(JA, L.156)

There were others who commented on the fact that getting to experience a sense of unease, work out why and what to do next in the VRLE might be the first opportunity they had of having this experience.

"But I feel like that's why using the VRLE just gave me something just so I am a little bit more prepared and I don't go into a situation where I am completely stunned by it and I'll instead know that this is causing me to feel a bit alarmed and I can sense something's not right here and then be able to say to my mentor you know, I noticed this, to see if it's just me picking up on things or if she's seen it as well which I think you know useful because being in first year I don't have that experience yet as much as others."
(S, L.144)

Though there were also others who felt that on balance the VRLE would be better used for different skills because they believed that skills such as clinical intuition could only be fully realised in real life.

"I feel for some sessions the use of VRLE would be more relevant than others, for example practice of clinical skills such as urinalysis rather than skills such a gut instincts which can only be fully experienced in real life."
(QID 2138, L. 280)

A review of studies concluded that clinical intuition is comprised of experience of healthcare along with clinical knowledge and that analysis and synthesis of intuition must be integrated with clinically measurable observations (Melin-Johansson et al. 2017; Collington and Fook 2019). So, although the sense of unease is an experience within the VRLE that several of the RPs commented on, there was not anything

clinically measurable at this point in the VRLE. Whereas when they examined the baby further on in the VRLE, there were clinically measurable observations they could make such as bruising to the conjunctiva of her eyes (Figure 39) and body. This was another aspect which RPs linked to in their discussion.

> *"When enquiring about Evie's eyes and the marks on her body and seeing the response it encouraged, this raised alarm bells for me."*
> (G, L.168)

Figure 39 - Baby Evie's subconjunctival haemorrhages.

These observations could be used as clinically measurable aspects along with information provided in the mum and baby's notes related to age and other important information required to build a clinical picture (Appendix 13). This research has shown that this combination allows them to practise analysis of their intuition in conjunction to already recorded information and from that develop a synthesis of what their clinical intuition was telling them.

7.3.2.3 subtheme - VRLE impact for those new to the concept of clinical intuition

Clinical intuition is a tool which is present to varying degrees in individuals and develops over time. However, there is no evidence that seniority and experience is linked to clinical intuition ability (Rosciano et al. 2016). Despite this, RPs felt that they were experiencing fewer physical manifestations of clinical intuition within the VRLE because they were in the early years of their healthcare education.

> *"I think probably because we are very new to it and the gut instinct will maybe kick in as we get to know it a bit more."*
> (C, L.55)

Others felt that having the VRLE gave them opportunities to develop their clinical intuition so they could be more like the professionals they observed and worked with in clinical practice.

> *"Especially like gut instinct there are so many professionals who just have that gut instinct and it gives you that hope that maybe it is something you can learn a little bit in that environment ummm so I did enjoy using it, definitely..."*
> (J, L.133)

And of those who felt they had less pronounced skills of clinical intuition, the VRLE offered them a place to begin experimenting with this important aspect of clinical practice:

> *"I think you know useful because being in first year I don't have that experience yet as much as others."*
> (S, L.144)

This was echoed by RPs who were further along in their degrees.

> *"I personally think that the current form of VRLE and topics addressed within it at this time would be most effective for a first year student midwife before they have gone out on placement and experienced being in women's homes, to help them to gain experience in what to look out for and the give an insight."*
> (Questionnaire data ID ending in 8341, L. 354)

Researchers agree that clinical intuition aids complex decision making and is at the core of holistic healthcare (Smith et al. 2008; Jackson 2022; Lame et al. 2023; Shorey and Ng 2023). It has been suggested that reflection, research and clinical curiosity are vital components in developing clinical intuition from an early stage of healthcare education (Lyneham et al. 2008). However, other researchers argue that clinical intuition is not accessible to inexperienced healthcare practitioners (Greenlaugh 2002; Nyatanga and de Vocht 2008). More recent findings suggest that confidence in clinical intuition increases with practice (Phillips 2013, Campbell and Angeli 2019). Therefore, it can be surmised that Lyneham et al. (2008) were correct in their assumption that it is possible for healthcare students to begin practising their clinical intuition from early on in their education. Furthermore, this has been upheld by these qualitative contributions of the RPs collective experience within the VRLE. As discussed above, the data from this research demonstrates that most RPs felt the VRLE supported them to experience a physiological manifestation of their clinical intuition such as feelings of discomfort and psychological feelings of discomfort such as urge to move their avatar to a place of safety.

These responses to the scenario in the VRLE offer healthcare students one way to identify with their role as student and future healthcare professionals. There is existing evidence that the virtual environment supports the acquisition or improvement of clinical skills for hands on techniques for routine, urgent and emergency healthcare (Seymour et al. 2002, Cooper et al. 2017) and more limited exploration into the value of VR for clinical skills related to effective communication (Bailey 2012, White 2016). One of the avenues explored with this research was the impact of VR on clinical skills related to safeguarding which incorporates both of the above areas of clinical skills. Additionally, as discussed in this section, it incorporated opportunities to practice reading between the lines of what the people are not telling you directly in order to deduce what other care or action they may need to be offered. These skills can be introduced in theory sessions, but healthcare students need to be able to apply the theory to some form of clinical practice, including simulation of healthcare, in order to maximise the development of new skills and to support identification with their healthcare roles (Ogard-Repal et al. 2018).

7.3.3 Theme three - Identification with role and professional identity

The RPs communicated that they felt VRLE helped them to identify with their healthcare roles because it had given them practice opportunities during which they felt were able to familiarise themselves with skills, increase their knowledge of how to behave during clinical practice, test their reasoning and problem solving.

> *"I always think safeguarding is a really hard thing to learn how to do. You can learn the theory of safeguarding but actually to go in and be making decisions like that is a really good way to learn. I really liked it."*
> (C, L. 36)

The RPs feedback overall indicated that they were able to reconcile the fact that the VRLE was a simulation of clinical practice in which they could become absorbed in the learning scenarios whilst relating it to the impact a similar scenario would have in the physical world on themselves and people they provided healthcare for.

> *"… it's definitely helped me to think back on some of the situations I was in before and how going forward I would adapt my own practice to sort of to sort of look at everything as a whole rather than just going in and looking at the pregnant lady and knowing there is a lot going on but I didn't deal with a lot of it because my mentor was."*
> (M, L.143)

As this RP highlighted, the benefit of this could be limited by the amount of experience already had but the VRLE experience still had value in establishing role identification.

> *"I think you do still learn things from it anyway because it's more exposure to a safeguarding concern, so I still felt like I gained something from it. Learning something new as in what I would do manage that…no. To be fair I have had a lot of safeguarding jobs on the road so I have got quite a lot of practical experience in it so I don't know whether that does influence it."*
> (J, L.186)

Other RPs reflected on how the VRLE could challenge them to think about safeguarding families in a different way to the theory sessions.

> *"I thought it was good having lots of different characters as well all in the one family and that some are more difficult to deal with than others which I think is very realistic and with the theory you sort of think that maybe that… there's gonna be… you know that there's gonna be a shrinking violet woman and quite a domineering man just because of all the theory and actually having it the opposite I thought was quite good and just the different personalities in the characters came out…which was nice. It did make it very realistic."*
> (H, L.38)

They then discussed how the VRLE made them think about the way they currently work and how they might need to do this differently.

> *"I think as paramedics to be fair we do get stuck on the patient in the house and don't really tend to take a great insight on the surroundings that we're in we're all quite blinded when we do go into the patients house and we do just kind of focus don't really take a great insight into what's probably going on in the house so I think we probably miss quite a bit and with that virtual tool I think it will definitely help with the paramedics."*
> (P, L.187)

These finding demonstrate that healthcare students' identification with their role is complex in its entirety and varies for each healthcare student. There is a plethora of literature which states that healthcare roles require them to ask intrusive questions about people's lifestyle choices in order to determine which healthcare options a person may need to be offered which they fear will negatively impact on the therapeutic relationship (Wenberg 2014; WHO 2016; Oni et al. 2020; NICE 2021, Kalamkarian et al. 2023). Understandably this causes healthcare students concern when deciding if they are ready for these challenges in clinical practice placements. During the Covid-19 pandemic these virtual practice opportunities were of pedagogic necessity due to reduction in clinical capacity, especially for first year healthcare students who were unable to undertake clinical practice placements for an extended period of time (Keegan and Bannister 2021).

In the next section RPs gave examples of how the VRLE offered them space to work out ways to approach and resolve unexpected issues.

7.3.3.1 Subtheme - Challenging conversations and problem solving

The RPs commented on the fact that the VRLE gave them opportunities to practice problem solving and have challenging conversations. This ranged from:

Giving them space to think things through on their own.

> *"Although there were a few gliches [sic] I can really see the benefit of using VRLE to enhance learning. It was good to experience a potential situation and made me think about how to say things when put in a confrontational situation."*
> (QID 5398, L.356)

Ensuring the questions they asked within the VRLE were suited to the scenario's situation.

> *"I think this is a great way of learning. It allows you to think carefully and appropriate ways of approaching questions."*
> (QID 7113, L.372)

To being taught the responses that can be anticipated as being needed.

> *"I think the VRLE is the perfect way to teach students how to respond to parents and how to approach difficult topics."*
> (QID 0785, L.375)

Of particular focus for some RPs was on the specific challenging conversations that had to happen within one of the VRLE where one of the characters was a consultant and was challenging their level of knowledge compared to his.

> *"I agree with T that like in (our healthcare) environment with safeguarding we find it really difficult to emm bring things up and mention the word safeguarding because were always scared it's gonna cause a reaction but I think this vrle has really shown me kind of like how to bring it up and to not pansy around it and walk on eggshells and to just bring it up because there might be a valid reason, they might have insight like the dad, the one I did was the consultant and so his reaction to you was telling you more than if you hadn't asked at all so I think that was quite useful."*
> (Y, L.131)

Whereas others considered that the VRLE gave them space to develop confidence in their scope of practice in relation to initiating challenging conversations in other people's homes, no matter who the other person is or what role they have.

> *"I think it made me…it prepared me for how some people are gonna be more difficult than others and that some of the conversations that you might have do seem a bit the midwives have do seem a bit like prying into people's into people's lives but that's normal and that's ok. Because I think it's not your everyday conversations, I suppose, so that's helpful and … the fear of going into people's houses which is kind of a strange one as well so that was helpful.*
> (H, L.53)

RPs also discussed how the VRLE supported them to not only have a challenging conversation but to push this beyond what they might have done without the VRLE experience.

> *"On the Melser one I felt like I like was prompted to ask more questions in it than I probably would have done if I had been there in person. So, like pushed them further with asking the questions and that kind of thing."*
> (V, L.14)

> *"I thought that it was really helpful to go through this as I was reluctant to ask further questions but felt like the scenario guided me through to ask more and it was a safe environment to do it in. It also helped to confirm that we should not make snap judgements as things may not always be as they first appear."*
> (QID 7570, L.340)

More detail about how RPs felt about this will be discussed in the safe fails subtheme (section 7.3.3.3). Research on hybrid teaching which included a form of virtual placement through use of interactive videos concluded that this is a feasible form of clinical practice experience (Kasal et al. 2021; Salje and Moyo 2023).

However, the RPs from this research indicated that there are aspects which could be improved such as allowing for individualisation of the scripted flow of the story within the VRLE.

RPs discussed how they felt that these placed limitations on their preferences about how they wished to conduct their clinical practice:

> *"I think that like you know obviously it's virtual reality so it's quite structured so you had to do one task followed by another I would have liked the option of different activities instead of just having to make the tea or whatever."*
> (X, L.167)

RPs gave examples of ways they felt that their way of undertaking clinical practice in certain situations would vary from the choices the VRLE offered them. This limitation could impact their development of autonomous practice (Orsini et al. 2016) and would need to be considered in any future VRLEs.

> *"I don't drink tea or coffee or milk but if I get offered a cup I sometimes take it because it can be offensive to some people to not to, especially in certain cultures that I've experienced but there's no option for that, do you know what I mean? So that's a black and white answer."*
> (I, L. 184)

> *"Also, in the Parvel VRLE it asked for example if we would accept a cup of tea, and the options to choose from were, I felt, both irrelevant to my reasoning."*
> (QID 1786, L.362)

Equally importantly, the lack of individualisation within the dialogue increased their feelings of vulnerability within the VRLE.

> *"Some things I said I don't feel I would say in real life - for example saying I've noticed its cluttered or the cannabis plants on the floor. Knowing the woman could get violent I wouldn't feel safe saying some things."*
> (QID 7638, L.344)

Finally, going steps beyond the wish for more individualisation was a suggestion that the VRLE could offer advice on how to improve their own dialogue when providing healthcare.

> *"…it would be nice if you could input the way you would ask the question yourself, for checking."*
> (J, L.147)

There is some room however, for consideration that although VRLE may not facilitate behaviour that is exactly as we might act as individuals, the way we do behave within VRLE is still important. Therefore, having some limits on choice can offer benefits in that it can still shape responses to clinical situations out of the VRLE (Stewart et al. 2023).

> *"It just kind of opens that door yeah to go "how do you feel about this?"*
> (R, L. 102)

Seth et al. (2011) compare VR to the cinema experience which evokes a physical and emotional response to the observed situations – for example, flinching when observing pain being inflicted on someone, but not actually feeling the physical trauma yourself. They argue that VR can be used in an impactful way for behaviour change despite the given scenario not being exactly the same as it would be in the physical parallel. This is further supported by research in the military which explored use of VR to place personnel in virtual environments that were designed to simulate the emotions required

for combat as part of their healthcare in order to assess individual suitability (Rizzo et al. 2011).

7.3.3.2 Subtheme - Bridging the theory - practice gap

The existence of a gap between healthcare students learning theory and being able to apply the new knowledge to clinical practice is widely accepted (Monaghan 2015; Hussein et al. 2017; Greenway et al. 2019).

The RPs offered insights into the impact the VRLE had in relation to offering them a place to bridge the gap whether they were on a block of academic study or a block of clinical practice.

> *"It was interesting and engaging way of learning such an important topic. It has helped me to 'bridge the gap' (between academic and clinical placement blocks) and taught me to trust in my gut instinct alongside more about referrals."*
> (E, L.195)

They considered the VRLE to offer a way to engage in their learning, a space to revise, or to undertake clinical updates.

> *"Felt this is a really good way to teach as it kept me engaged in theory and practice."*
> (QID 3686, L.253)

> *"I found that useful just to refresh the learning we'd done in the classroom before going out on placement because it felt like we did that so long ago that initial training session."*
> (V, L.54)

The RPs felt the VRLE gave them time to work out how to improve their autonomous practice skills.

> *"I always think safeguarding is a really hard thing to learn how to do. You can learn the theory of safeguarding but actually to go in and be making decisions like that is a really good way to learn. I really liked it."*
> (C, L.36)

> *"For me it was a way to be able to get into the actual situation, a way to visualize what a situation can be really and how you would react to it."*
> (B, L.72)

Healthcare students traditionally learn in blocks of theory followed by blocks of clinical placement, which inevitably causes a gap between the two to occur (Zeiber 2019). However, despite use of simulation mannikins, role play and case studies, there has been no effective, accessible or reliable solution identified to address this complex

problem (Ferguson et al. 2014; Labeau 2019). There are schools of thought that are situated in the belief that learning experiences within the virtual environment facilitates the development of spatial contexts. (Botella et al. 2017). This constructs spaces for storage of memories of learned skills which can then be more easily accessed for future use (Chun and Jiang 2003, Krokos et al. 2018).

It can be seen from the findings that the RPs believe the VRLE helped them to apply theory to clinical practice within the VRLE and make valued connections between the two, whether it was to refresh knowledge learned previously before returning to clinical practice or to apply knowledge taught more recently to clinical skills practice.

7.3.3.3 Subtheme - Safe fails

Ensuring no one comes to harm is a key component of good healthcare, one that is under review and intense scrutiny (Francis 2013; Kirkup 2015; Cumberledge 2020; Ockenden 2022) as well as high on the agenda for healthcare planning on a global basis (WHO 2021). Being competent to ensure the safety of healthcare service users is understandably a concern of healthcare students for many reasons and the RPs discussed their desire to have opportunities for virtual safe fails in practice in order to safeguard against them mistakes in actual clinical practice.

> *"So it kind of helps you kind of yano just that practice element of trial and error like you can pick the wrong question and it doesn't matta [sic], at least you know then yano ok I wouldn't' say that or I would change it or adapt it to say this instead because I know that might be a better way to say it so I feel like it's not the real thing but it's close enough, especially in a situation like safeguarding. It's quite a serious thing you don't wanna [sic] be wrong in what you're saying."*
> (S, L.132)

This included wanting a place where they could practice clinical skills as much as they needed to for their individual learning.

> *"It's like PROMPT ummm there was a study day there not long ago in the Trust and if you had the virtual thing you could have sat and practiced at home as much as you want. Even if you just practice as an individual when practice team work for emergencies….I'm a practical learner, I need to visualise and I want to be able to safe practice."*
> (B, L.123)

Though RPs did raise concern that the VRLE scenario was open to interpretation and that nuances in behaviour could be missed when in the VRLE compared to when in actual clinical practice.

"I think it depends on how you interpret it and how you would deal with it in a real life situation if that makes sense. So you don't get that real feeling that …you know…that conversation you're having because you might interpret it as passive or aggressive or whatever."
(G, L.166)

Whereas other RPs felt that the feedback compensated for this and meant they could still benefit from the safe fails practice.

"I also believe that the feedback from the VRLE was helpful. Making good decisions and mistakes on there, meant that if we made a mistake that was a bit obvious, no one else saw. Also, if we made a good judgement call, the feedback might include something we hadn't factored in e.g. oh yeah, I'm the only adult witnessing this! I'm responsible right now! I think this leads to better judgement calls."
(RC, L.194)

Further discussion occurred about the feedback in the VRLE. Some RPs shared that they valued the feedback provided in relation to safe fails.

"I liked the feedback during the VRLE as it helped give pointers where I went wrong or that I had made the right decision."
(QID 7762, L.342)

"One of the things I found really helpful about the questions and the feedback we got from the families was um was a couple of times that I chose to do something because of…I felt like it was the right thing to do and the feedback said "yes, correct because this is going on" and I thought "oh flip" I hadn't even noticed that!"
(R, L.90)

However, the RPs suggested additional ways in which learner feedback within the VRLE could be enhanced to offer more to healthcare student as individuals.

"It might be beneficial to have more options for actions available to the MW/HV and the possible implications of those actions once chosen that path, even perhaps an entire pathway of how badly it could turn out ie dad becoming aggressive so you have to leave, or another route whereby your actions don't provoke him etc.…"
(QID 1870, L.363)

"I found it useful but I also found it slightly difficult because the questions were obviously pre-loaded so obviously you don't put in what you would ask so when it asks the question that's not necessarily something that I would have asked…so I still don't know how my questions would flow or something like that. Like I now know things that I should ask but I don't know what would happen if I asked what I would naturally ask…if that makes sense."
(Y, L.124)

> *"Sometimes if a parent or anyone mom or dad says something to you and you know what they have said isn't right or that you need to intervene and you don't know how to approach it you know "I don't want to offend you but I do need to be honest with you" so examples of how to give that information and a little bit more of that I n there would be nice. A little bit more of "if this happened this is how you can approach it , I find that really helpful."*
> (Hi, L.153)

There were a number of RPs who felt that they would benefit from having in-class feedback sessions as well as that given in the VRLE.

> *"I think that having a personal summary of how you've done is good, but I also feel that sometimes it can be beneficial for others to be able to discuss it with other people just in case there are things that they picked up on that you didn't pick up on."*
> (S, L138)

> *"And like I think it would be useful to go over like the paperwork in the classroom because you might miss things like how to put it down on paperwork and like I'm slightly older and T is slightly older and she's a mom so our gut instinct might be a bit more developed that some 18 year olds on the course so I think it would be really something that a lot of people would find beneficial."*
> (Y, L.141)

When developing the VRLE, as discussed in Chapter Five, feedback was built in as a way to explain how the healthcare errors had occurred and to suggest more optimal ways of addressing the situation. However, in response to this qualitative feedback, opportunities to complete paperwork and formative group feedback sessions were implemented (Bajaj et al. 2018) as part of the new curriculum's safeguarding pedagogy for midwifery students. Work is ongoing to introduce this to other healthcare disciplines within the University.

It can be seen that the RPs collective experience of the VRLE was that it did support safe fails in virtual clinical practice. This preference to have a space for safe fails further demonstrates their desire to offer holistic and humanised care as discussed earlier in this chapter. Safarti et al. (2018) undertook a systematic review to explore the benefits of offering patient simulation exercises as practice to reduce errors. They found that while this facilitated learning, it was inadequate as an unsupported resource as the learning could be less or different than intended. The importance of providing students with a space to experience safe fails was also highlighted in an integrative literature review by Palominos et al. (2109). They also concluded that it was equally

important to ensure students were supported to lean from their mistakes to maximise the available learning opportunity.

7.3.3.4 Subtheme - Educational value

The importance of the students' perception of their learning experience is recognised to have an impact on the learning gains. Studies have found direct correlations between learner enjoyment of good quality education, subsequent learning attitudes including commitment to their academic theory attainment and clinical practice proficiency and perceived value of their education (Cybinski and Selvanathan 2005, Goodyear et al. 2016, Varthis and Anderson 2018). This was collectively reflected in RP feedback as demonstrated below.

The RPs commented on the VRLE providing a different way of learning theory.

> *"Overall I liked that we could see something different especially that we…I'm sure B would agree that ours is just PowerPoint, PowerPoint, PowerPoint all of the time whereas this was nice to do something different, to have a different way of learning to do something in a different way. It was nice for me to be able to do something different."*
> (T, L.134)

> *"I really enjoyed the VRLE it is a fresh new way of learning and really helps put yourself in the environment."*
> (QID 0851, L.376)

> *"I thought it was a really memorable way to learn. I mean that I find I can remember clearly a lot of what we learnt through the VRLE I think because it's going into a space and making decisions like that that I find it easier to remember than maybe other information that you're given over safeguarding. Perhaps because it just more mimics a real situation more."*
> (C, L.35)

Others considered the VRLE as a place where they could learn theory and then apply it to clinical practice.

> *"Felt this is a really good way to teach as it kept me engaged in theory and practice."*
> (QID 3686, L.335)

Fun was also highlighted as something available through the VRLE. However, they were of mixed views on whether this was a benefit and an encouragement to keep on learning or whether they would have learned the same from the traditional methods of learning theory.

"I thought it was really helpful and I actually found it kind of fun as well which was nice so yeah I would definitely do it again."
(H, L.66)

"The VRLE is a fun way to learn but felt I would have learnt more through other interactive methods or powerpoint. I didn't feel that the VRLE taught me more than photos and class discussion would have, which would have given more time for going through other things."
(QID 1778, L.358)

Research suggests that fun in education is important for learner satisfaction and to maximise the meaningfulness of the topic, but offering this in an interactive and multi-modal way is argued to be more effective than incorporating just one or two techniques (Baid and Lambert 2010). Other researchers argue that although these can improve learner engagement and satisfaction, the outcomes are no different to other forms of pedagogy (Sipiyaruk et al. 2018). On balance, the importance of fun in relation to providing learner satisfaction cannot be downplayed (Hege et al. 2020). Therefore, as these findings demonstrate, if VRLE makes education more fun, then the relevance of this needs to be recognised and considered as part of future curriculum planning and development though this should not take priority over the necessary content and intended learning objectives (Bryson and Andres 2020).

The RPs' expressed their appreciation of having repeated access to clinical experiences through VRLE as a place to practice their skills and to understand their role alongside other members of the healthcare team as they felt this would increase their commitment. These findings challenge previous research findings which caution that to maximise benefits the clinical simulation must be as realistic as possible in relation to the physiological impact (Skodova and Lajciakova 2013; Fitzgibbon and Murphy 2022). The avatars in the VRLE used for this research were static, without expression and communication was text based and yet the RPs still found the VRLE of benefit for their learning. In this way students can learn how stressors affect them as individuals and be supported to develop suitable coping strategies to improve their resilience and reduce burnout (Plack et al. 2022).

The collective feedback of the RPs indicated that this learning experience had been unique and one which added variety to their choice of learning tools. However, there were aspects related to the functionality that marginalised their enjoyment, which is how theme four arose.

7.3.4 Theme four - Functionality

Functionality as a theme arose from the RPs feedback about aspects of VRLE use that limited their access or complicated their use and this were organised into four subthemes:

    a. Battery and storage capacity
    b. Connectivity and firewalls
    c. Navigation challenges
    d. Clarity of information

Furthermore, it is notable that RPs shared some of the feedback in both the quantitative and qualitative data collection which could indicate how strongly they felt about the impact of the VRLE functionality on their experience.

7.3.4.1 Subtheme - Battery and storage capacity

RPs expressed frustration at the battery and memory consumption of the VRLE app.

> *"I had the same with it draining the battery so it was difficult if you can't plug in your laptop when using it but apart from that I had a good experience."*
> (L, L.5)

> *"I've got a MacBook Pro and I found that when I ran the application it was using all the computer resources, the ram or something."*
> (M, L.183)

> *"There are a lot of features and a lot of downloads which can take up a lot of space on a laptop/smart phone if someone doesn't have this."*
> (E, L.192)

The VRLE do take up a significant amount of storage space whilst in use as they need to provide an immersive virtual experience. This includes aspects such as ambient lighting, ambient noise and so on which places demand on the handheld device whilst in use. However, this adds to the degree of realism which the RPs appreciated as discussed in theme one.

Another important consideration is that hidden capacity demand such as security, aesthetics, reliability, speed and other vital components are required to give a good user experience is a known issue in relation to app user dissatisfaction and one for which there is no generic solution at this time (Hort et al. 2021). Research has shown that these factors can negatively influence intention to use smartphone devices to support education (Alghazi et al. 2022).

There was a significant number of RPs who found the VRLE of benefit and it is a concern that if they had not been participating in research then they may have not continued to use the VRLE.

> *"It is ok as long as your computer has the capacity as sometimes it could be quite slow and drained my laptop battery but otherwise worked well to improve my knowledge/ skills and confidence in these cases if I were to come across this in practice."*
> (QID 3486, L.368)

A generic solution to this capacity issue needs to be found to maximise the benefit to most healthcare students. It is recommended that when not in use nonessential apps can be offloaded to their network cloud until required for further use (Maray and Shuja 2022). With the clarity of hindsight this is something which could have been added to the information provided to support more RPs to use the VRLE without impacting on their mobile device storage capacity.

However, capacity would still be an issue for those who wanted to add on the app required to run HMD which allowed the RPs to completely immerse in the scenario as indicated by this RP.

> *"I didn't have enough storage on my mobile even with removing a load of apps so couldn't experience the VR headset and did find that it drained my laptop battery."*
> (X, L.172 and QID 5398, L.356)

Furthermore, although addressing capacity issues would offer a partial solution for most, this would not be of use to address the issues related to connectivity and firewalls.

7.3.4.2 Subtheme - Connectivity and security firewalls
This feedback was offered when the VRLE were demonstrated and used in the classroom environment as well as in the qualitative and quantitative data collection. It is clear that the RPs felt frustration with the connectivity and device download privacy issues.

> *"…the time it took to log in to the VRLE was also really quite long, and sometimes it completely froze meaning i [sic] had to start again from scratch."*
> (QID 1803, L364)

> *"Trying to download took hours as my devices and antivirus kept throwing it out and not allowing. Halfway through experience each time used it I*

kept getting put back to beginning very frustrating. Always in the same place"
(QID 7604, L.343)

The RPs were asked to download the VRLE app prior to attending the demonstration sessions but not all did so and therefore they needed to download them at the beginning of the on-campus sessions. This will have increased to the demand on the university's internet which would have reduces the speed of the wifi for downloading apps. Additionally, they all first experimented with the VRLE in the same time frame which again led to a surge in demand on the broadband internet connection.

However, as this RP pointed out, it may be that some might not have access to the internet at home.

> *"It also assumes people have Internet connections and this again may not always be of access or available to every person."*
> (E, L.192)

There were no reports of this occurring when the RPs used the VRLE on their wifi at home, however research found that poor internet connectivity was the biggest challenge for university students who wished to use self-directed learning which required internet access (Chung et al. 2020; Peimani and Kamalipour 2021). There is concern that this is doing too little to reduce digital inequality as universities should be a place where students can have equitable access to education in its myriad forms and thusly the internet networks also have a part to play in ensuring universities are able to reduce this inequality (Rahiem 2020).

There were also frustrations expressed by RPs who had downloaded the VRLE app as requested before the in person supported demonstration sessions. Notedly, they commented on complications with their personal device's security and firewall permissions preventing them from downloading the app without extra support.

> *"Trying to download took hours as my devices and antivirus kept throwing it out and not allowing."*
> (QID 7604, L.343)

> *"When first installing VRLE, anti-virus software kept seeing the program as a threat and kept quarantining fieldscape. Had to reinstall it about 4 times."*
> (QID 7704, L.345)

The pre-use information provided to RPs when they were given their download and log in details did not offer advice about how to work around firewall and security flags,

though this was offered when RPs highlighted this challenge and was resolved with minimal support after that. On reflection, these issues should have been anticipated due to the amount of choice RPs were able to make in relation to the device they wished to use to access the VRLE, with some opting for their smart phones, some preferring to use their laptops, PCs or smaller devices such as handheld tablets, or a combination of these.

7.6.4.3 Subtheme - navigation challenges

As mentioned above, the RPs were able to choose which devices they installed the VRLE app on. These choices did impact on their experience, for example RPs found it difficult to move around or to read text fully when using the VRLE on their phone and also remarked on the experience being slower on their phones.

> *"…on the phone it was hard to navigate round…"*
> (D, L.163)

> *"Using my phone, some of the text overlapped which was difficult to read so i [sic] found myself missing important text. Also very slow, and hard to use on a phone."*
> (QID 2889, L.328)

Other RPs mentioned that the VRLE worked better on some versions of operating systems than others.

> *"Disappointed the programme doesn't work with Microsoft windows 10s. When using the app on my phone; when given multiple choice options of what to say/what my concerns are the writing overlaps so I can't read the text options and don't know what I'm choosing."*
> (QID 3631, L.337)

Most of the functionality feedback related to challenges with navigating within the VRLE.

> *"Anyone find it clunky moving wise? I found it quite… it hung quite a lot so it didn't…move as the demo."*
> (Ba, L.182)

> *"I was just gonna say that on the phone it was hard to navigate round and I kept walking into walls where it's so tiny so if there was an option where we could click on it and make it bigger that might work."*
> (D, L.163)

> *"Very glitchy, found I was going through walls or getting stuck a lot."*
> (QID 6745, L.370)

To trigger the gut instinct or alarm bell feedback the VRLE user needs to be near the built-in trigger point, which led to frustration for some RPs who had identified that their clinical intuition had been alerted by something they had experienced in the VRLE before they walked near the point the trigger was set. In addition, the RPs stated they wanted opportunities to indicate what specific thing has triggered their clinical intuition so the appropriate feedback can then be given to enhance the individual's learning experience as well as more freedom to explore within the scenario.

> "I was also unable to use the alarm bells at the relevant parts, ie: I clicked alarm bells for the bottles but it came up with the bruising information."
> (E, L.188)

> "In the one I visited I wanted to open the cupboards a bit more and explore around the house because when I go into patient's houses one the pretense of getting their tablets or whatever you know of have snoop around and see what else is again on in the house are they just living out one room and that so to be able to have a look around the house especially when you've got gut instincts that there's something wrong anyway you base quite a lot on the rest of the house as well."
> (Y, L.151)

On discussion with the developers, they have proposed that this could be amended for future builds.

Surprisingly there was also navigation feedback from an RP which was specific to difficulties figuring out how to gain access to the family's houses or how to do other routine tasks.

> "For me the hardest thing I found was how to open the front door once I worked out how to ring the doorbell and walk to the right place it was fine…. (Ph, L.177)

> "…for example, putting the kettle on or whatever else…ammm that was a bit kind of confusing"
> (Ph, L.181)

Although there was just the one RP who feedback about this, it is interesting for me as a researcher and does raise questions about why this might have been a problem. Within the VRLE the access to houses was the same as what the RPs would need to do when working out in community during clinical practice - walk up to the door then knock or ring the doorbell. Figure 40 shows the outside of the Melser family's home in the VRLE with the image to the left showing the door closed and then opened after a reasonable delay. The RPs needed to walk to the door, ring the doorbell and then knock on the door once they realised the doorbell was broken.

Figure 40 - The Melser family's front door (l- closed, r- open).

Figure 41 below is an uncropped screenshot taken outside of Parvell family home in the VRLE showing app controls used to navigate VRLE including the avatar's motion direction dial to the far left. The RPs needed to walk the avatar to the door and then raise the avatar's hand to knock on the door or ring the doorbell. It is interesting that this was not intuitive for the RP quoted above considering the earlier discussion on feedback from the RPs about the VRLE feeling real.

Figure 41 - The Parvell family's front door.

Research by Gallup et al. (2019) suggests that not all behaviour in VR is the same as would be outside of VR and provided examples of virtual diving cages and how people

report feeling fear and yet are observed not to hold their breath despite being (virtually) deep under water. They propose that this may be because most people who use VR are not fully immersed. Therefore, if RPs had open access to a handsfree VR headset (HMD) they would then have been able to move about within the VR in a fully immersive way which may have made them behave in a more intuitive way. As discussed previously the use of HMD was limited to on campus use unless the RPs happened to own a device of their own and this lack of access has been shown to negatively impact on the available learning benefits (Diaz et al. 2019). It is worth noting that unlike smartphones, the HMD is something that was not a common household item at the time of this research and therefore could add to navigation confusion rather than enabling it as the RP below commented.

> *"I tried the headset glasses, it was really strange because I haven't done anything like that before but it was kind of cool but I felt like it was harder to move though with the glasses though whereas on the computer it was a lot easier to move around and to click on things but that could just be me being a bit of a technophobe…"* (H, L64)

Figure 42 was taken during a full immersion experience during a demonstration of the phase zero concept testing prototype VRLE for this research at a conference. The person in the image had just stood up after kneeling down to look at equipment on a lower shelf of a clinical trolley. The intensity and enjoyability of this experience of the environment moving and behaving as it would in real life, is clearly visible on her face. She then shared this image on X (previously known as Twitter) as part of her conversation about the conference where she had experienced the VRLE.

Figure 42 – Reaction during full immersion experience of the phase zero concept testing prototype VRLE.

However, it must be acknowledged that full immersion with HMD is not beneficial for all VR users as they can cause feelings of motion sickness and other discomfort as indicated by these RPs.

> *"I actually get quite motion sick with like anything like that so I found it quite difficult actually to fully immerse myself in it without kind of feeling a bit off."*
> (K, L.169)

> *"I needed a few breaks during the headset use, as it made me feel a little sick (reminiscent of travel sickness,) but I enjoyed the overall experience."*
> (QID 1835, L359)

Overall, it can be seen that the navigation issues experienced by the RPs were caused by various factors such as the RP having to learn a new way of navigation with motion direction dial control (bottom left of fig 41 showing the Parvell family's front door) and being too reliant on the VRLE to direct the learning instead of the RPs doing this in a more autonomous way. Many of the reported factors are able to be resolved with some minor adjustments to the information provided to RPs before use.

7.6.4.4 Subtheme - Clarity of information

Less easily resolved are the reported issues with clarity of information within the VRLE which will require adjustments dependant on what is causing the problem within the coding of the VRLE app. The VRLE were proofread and tested numerous times by the VRLE technical build team and me as well as some volunteers. Despite these efforts there were aspects of impaired clarity experienced by the RPs.

> *"Found when alerted the alarm bell the dialogue box was blurry and unreadable, therefore leaving a poorer experience when using the VRLE. Also, if you did click the alram [sic] / gut instinct it didn't necessarily relate to the issue I had pressed it for."*
> (QID 1786, L.362)

As the quote below demonstrates some RPs wanted step by step guidance rather than using their initiative to progress through the VRLE.

> *"It was unclear what to wait for next, I would read the text and advice then not know what to do next, each text should lead on to the next direction…"*
> (QID 8664, L.253)

Research has indicated that quality is a key component of user satisfaction and that post release errors in the experience are reported by users no matter the size of budget or development team (Zheng et al. 2019; Politowski et al. 2021). They argue the need for automation in testing before release which would undoubtedly relieve the

pressure on academics wishing to contribute to the creation and help ensure development of VRLE is likely to be an affordable option in the near future (Bergdahl et al. 2020).

7.4 Discussion

7.4.1 Relevance of findings to research question one

What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?

The RPs reported physiological reactions to events which happened within the VRLE including feeling uneasy when their direct route to the door was cut off, alarmed when they noted the bruising in the baby's eyes, intimidated by the way they were spoken to at points, suspicious at what information might be deliberately withheld from them and more. As discussed, the RPs were aware they were using a safeguarding families themed VRLE and this will have made they more alert to the presence of maltreatment of children and / or other family members. However, the scenarios were written to weave maltreatment indicators into the scenario with varying complexity. Some were easier to note whereas others were hidden and could only be discovered if they were responsive to their clinical intuition which would lead them to question aspects which would otherwise seem within normal limits if observed at surface level. For RPs who had experience with using their clinical intuition this gave them more confidence in their ability to use clinical intuition as part of their overall developing skillset. For RPs whom clinical intuition was a less familiar concept, or they had less practice opportunities to date, the VRLE gave them a place to experience this, to explore how to work with it to develop their clinical practice in this area and to understand how to use it as part of a wider range of clinical skills. Overall, regardless of previous experience, the RPs found the VRLE offered value for learning and practicing use of clinical intuition in a safe space where they could make mistakes without consequence.

7.4.2 Relevance of findings to research question two

To what extent does healthcare students use of VRLE relate to the humanisation of their healthcare?

There are a multitude of aspects which comprise humanisation of healthcare (Busch et al. 2019) and this research has concentrated on exploring the 6Cs of healthcare, holism of healthcare, and boundaries of healthcare. The RPs describe the VRLE as helpful for feeling compassion in difficult situations and to work out how to be empathetic, particularly in situations they had not experienced before. The VRLE was

judged to be of use for exploring and reflecting on how to view situations differently in order to practice giving care most effectively and that this added to their competence. The necessary difficult conversations that were included in the VRLE were discussed favourably as a useful way to improve communication skills in challenging circumstances which they also reported had given them courage going forwards to do this in clinical practice. Their commitment to learning and developing clinical skills was clear and VRLE were spaces where they could proceed with these at their own pace when the timing was right for them as individuals.

The RPs felt that the VRLE helped them to learn how to make their care holistic because the VRLE supported them to reflect on everything that makes a person who they are and makes them behave in the way they do and that there were layers within each of these. They highlighted that this was important to their clinical skill practice. Boundaries of care were able to be explored using the VRLE though RPs did feel that this would have been improved with more flexibility built into the scenarios so they could go further as individual learners where they wished. The RPs felt that the VRLE supported them to develop their professional identity and that they could use this to benefit their identification with their role in relation to safeguarding. This was notably apparent for those healthcare professions where safeguarding is not built into the theory in the early years of their degree and they instead rely on what they learn about safeguarding whilst in clinical practice. The VRLE gave them a space to learn and practice safeguarding skills in for their role before having to use them with real life people which is further evidence of the value VRLE can offer to humanisation of their healthcare.

7.4.3 Relevance of findings to research question three

To what extent does the VRLE functionality impact healthcare students' perception of their ability to engage with the given scenario?

The functionality of the VRLE was impacted by battery demand, storage capacity and connectivity issues which marginalised the benefits the RPs felt they could have had, beyond those which were reported. The RPs also experienced frustration with navigation within the VRLE, some of which were likely related to the intermittent connectivity experienced with simultaneous multiuse on campus as this was not reported when the RPs used the VRLE in their own time. Others were technical issues such as too precise of placement of the trigger points within the VRLE or navigation using the directional dial in the VRLE when on their mobile phones. Functionality is an important aspect and one which could reduce the known benefits of VRLE, for example if healthcare students chose to use it less as a result of expecting the functionality to be

an issue. Ensuring that VRLE is an equitable experience for healthcare students is also an important consideration.

7.5 Chapter summary

This qualitative research data has provided insight into the collective experience of the RPs use of VRLE. The discussion of the themes and subthemes has explored the significance of the RPs' feedback in relation use of VRLE as a tool for healthcare education. There were numerous aspects within the emergent subthemes such as the difference in experience depending on the RPs existing level of clinical practice experience and chosen healthcare profession as well as the VRLE's ability to provide a space for all healthcare students to study skills related to profession generic healthcare topics such as safeguarding children. The thematic connectivity to the research questions will be discussed for the final time in relation to combined quantitative and qualitative findings in the next chapter as well as lessons learned and recommendations for further research.

Chapter Eight: Discussion, contributions to knowledge and recommendations

"It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change." (Meggison 1963, p.4)

8.1 Introduction

As the opening quote to this chapter says, it is important to be adaptable and responsive to change and it can be argued that this quote can be applied also to healthcare education. As healthcare professionals we are responsible for providing healthcare and healthcare education which is focussed on offering tools that enable students to grow into their chosen professions on a foundation of love, art and science (Barrit 2016; Moudatsou et al. 2020; NMC 2023). The healthcare education must be fit for purpose and to do this it needs to evolve in response to changes in ways which support healthcare students to learn skills for their chosen professions in clinical working environments.

This research sought answers to the following questions within which love, art and science are considered as equally important aspects of holistic healthcare:

1. What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?
2. To what extent does healthcare students use of VRLE relate to the humanisation of their healthcare?
3. To what extent does the VRLE functionality impact healthcare students' perception of their ability to engage with the given scenario?

In this chapter, answers to the research questions arising from the combined quantitative and qualitative analysis are presented. Lessons learned are shared along with reflection of the thematic connectivity to action research and recommendations for future practice and research round up the journey this research has taken me on.

8.2 The value action research has added to this thesis

On reflection throughout the writing of this thesis, the dynamic flexibility of action research has made me think of a mandala in physical form. When you move the components of a mandala in their orientation to others, it changes the way the object functions and yet all the essential components are contributing to the changing structure of the mandala. The same can be seen to be true with the way love, art and science are combined into holistic healthcare and how this is threaded through everything we do as healthcare professionals. Dependant on the needs of the individual during the healthcare episode - whether this has been intuited, requested, measured or a combination of these - the essential components of holistic healthcare remain the same. Equally importantly they also become more than the sum of their parts depending on how the mandala of holistic healthcare is shaped to meet the needs of the individual. For healthcare professionals to be able to offer this, they must first be taught the skills in a variety of ways that are reimagined as and when it is

necessary. This is the essence of my thesis, a reconfiguring of the mandala for holistic healthcare pedagogy and education.

8.3 Research findings and contribution to knowledge

8.3.1 Research question one

Research question one asked: "What is the impact of VRLE on healthcare students' self-perceived ability to utilise clinical intuition?"

Responses grouped under theme two – physiological manifestation of clinical intuition - have had the most influence in answering this research question.

Action research is best known as a fluid and dynamic emergent process with no definitive end point that should incorporate collaboration with RPs into the ongoing development and transformations of the area being researched (Slattery et al. 2020). This process is synergistic with clinical intuition which can also be represented as cyclic learning (Power 2015). Theme two addresses the VRLE generating physiological manifestations of clinical intuition within the RPs as well as being perceived to offer them a place to practice and develop clinical intuition as discussed in Chapter Six and Seven. This finding can contribute to further action research phases. For example, it could be included in emergency skills VRLEs to support students to intuit unidentified causes for patient deterioration. Having skills of clinical intuition in these time critical situations can prevent further deterioration or ensure appropriate specialists are aware of the emergency in a time appropriate manner (Pearson 2013; Muoni 2013), though as discussed in Chapter Seven how much this is influenced by experience is yet to be determined with any confidence (Pelaccia et al. 2020).

Experience should not be a necessity for clinical intuition but it may enhance the perception of being able to use it within the VRLE. Intuition has been described as "knowing without knowing how one knows" (Nyatanga and de Vocht 2006, p.492). The justification for intuitive practice has been called into question by those who champion the value of evidence - based practice, decrying any healthcare provision which is not able to demonstrate the research underpinning variation in clinical techniques (Lamond and Thompson 2000). Barnfather's (2013) belief that intuitive healthcare is an essential aspect of the tacit art of midwifery care makes it clear she is firmly in the camp of those championing use of clinical intuition in healthcare. Angeli and Campbell (2017) suggests that intuition is an unconscious form of coding observed or sensed concerns and that this is a learned skill developed as part of ongoing clinical practice. Nyatanga and de Vocht (2006) propose that intuition has a place within healthcare but that it

should be used in conjunction with other forms of knowing such as empirical evidence as intuition is not infallible and may lack accuracy when tested empirically.

Interestingly, Greenlaugh (2002) strongly believed that there is a false dichotomy between the art and science of healthcare practice within the academic based healthcare curriculum, and that this is not reflected in the learning offered in clinical practice settings where she argues that clinical intuition is recognised as a component of rigorous decision making. She recommended that practitioners consider intuition to be scientific and able to be taught, giving rise to a need for improvements to the school of thought around evidence-based practice. Finally, research has demonstrated that intuition is irrevocably linked to competent clinical practice and should be used in conjunction with evidence-based practice in order to offer well rounded healthcare (Witteman et al. 2012; Lame et al. 2023; Shorey and Ng 2023).

Contribution to knowledge:

The RPs qualitative contributions support the importance of developing their intuition for use as part of their clinical practice skills. Furthermore, they evidenced their belief that use of VRLE can play a part in honing this valuable clinical skill (Chapter 6 – section 6.3.7, Chapter 7 - section 7.6.2). In addition, they said that the VRLE gave them a place to work through safeguarding experiences which were new to them to develop skills which would also safeguard them as healthcare students out in practice. This included improving their understanding of when their instinct was warning them that they might be at risk from the situation and supported them to learn whether they could trust their clinical intuition in these instances (Chapter 7 - section 7.6.2.1). RPs requested other VRLE for use as part of a comprehensive healthcare pedagogy offer which would include traditional academic class-based learning, virtual environments, community and hospital-based learning (Appendix 7 and 15). However, there were improvements suggested which the RPs felt would make the VRLE a better experience and these will be discussed while considering the answers to research question two.

It can be seen from the discussions about theme two's contribution to answering research question one that RPs believe VRLE facilitate acquisition and development of clinical intuition, critical-thinking and decision-making competence. However, the need to do this without exposing clients, healthcare students and staff to unnecessary risk is also of importance (Makhele 2021). The answer to whether VRLE can contribute to this in balance with the other aspects healthcare students need it to offer will be discussed in relation to answering research question two.

8.3.2 Research question two

Research question two asked: - **"To what extent does healthcare students use of VRLE relate to the humanisation of their healthcare?"**

Responses grouped under theme one and theme three offered the most valuable contributions for answering this question. This is because they address the connection of VRLE use to the 6 Cs to holistic care, the impact this has on the humanisation of healthcare and the formation of professional identity.

Theme one – consideration of individual characters within the VRLE as a whole person

Effective action research outcomes should improve learning and subsequent actions should be used to work through any problems (Dick 2007, McNiff and Whitehead 2009). The discussion in Chapter Seven (section 7.3.1) about theme one demonstrated that the RPs were able to connect with the family members on an emotional level within the VRLE. Also discussed was the use of the VRLE as a tool to inspire and facilitate humanisation of care by working through how best to provide holistic care for these families (Chapter 7 - sections 7.3.1.a-g). As the RP qualitative contributions have shown, experiencing emotional responses to the VRLE scenarios has been possible even when used without full immersion – for example experiencing the VRLE on a tablet or laptop.

It can be seen from the RPs' feedback that they valued being able to practice in environments which are safe and can offer experiences which cannot otherwise be guaranteed (Chapter 7 - section 7.3.3.1, 7.3.3.2, and 7.3.3.3). This research has shown the importance of these for healthcare topics such as safeguarding. Without practice opportunities practitioners can be at risk physically or suffer from stress induced conditions after episodes of real-life experiences of offering this care or addressing these issues as aspects of holistic care provision (Marsh 2015; Hogg 2018). This can in turn limit the ability or desire to provide humanised care because of compassion fatigue (Cuartero and Campos-Vidal 2019).

In Chapter Six (section 6.3.8.2 and 6.4.2) the RPs quantitative feedback was ambiguous about the impact of the VRLE on their ability to humanise their healthcare and this is likely due to the limitation imposed by the design of the data collection instrument. However, as discussed in Chapter Seven, this research has shown that RPs perceive the VRLE to be where they can explore scenarios that trigger emotions and practice how they will respond to these (Chapter 7- sections 7.3.1.1e, 7.3.1.1f and 7.3.3.1). As discussed above, the RPs' concern and consideration of the VRLE scenario characters' wellbeing is evidence that they are humanising their healthcare

provision. Thusly, the development of personal resilience can be supported within the VRLE which is of benefit to them as student and future healthcare professionals.

Cardi et al. (2017) reminds readers that healthcare professionals are duty bound to take into consideration the rights of women in their care and the fact that they should be treated with dignity and all other human rights. It can be recognised as a challenge to provide equal healthcare by offering all women these rights, for example if the woman involved in the episode of healthcare is suspected of abuse or if she chooses to be with a person who perpetuates abuse on either her or the children. Research by Marsh (2015) highlighted the detrimental emotional effects on midwives when providing humanised care for women of safeguarding concern, referring to this as "emotional labour".

This phrase is reflective of the difficult balance midwives were required to maintain between safeguarding their relationship with the women in their care, safeguarding the wellbeing of the child and providing a service that encompassed the 6Cs, whilst still protecting their own emotional wellbeing and self-belief in themselves as healthcare practitioners. Curtain et al. (2020) highlighted the importance of humanisation of care in reducing authoritarianism, improving collaborative decision making between the health service user and healthcare provider as well as fostering increased levels of trust. The RPs' feedback identified areas which they were concerned about in relation to delivering effective safeguarding care without allowing their inexperience or personal bias to impact on the care and that the VRLE offered them a solution to this (Chapter 6 – section 6.3.4.2 and Chapter 7- section 7.3.1.1f and 7.3.1.1g).

As discussed earlier, another factor related to being able to humanise care is the ability to empathise with the situation of others. Jones (2019) discussed research undertaken with children by Bailey and Bailenson (2017) and suggested that there were indications that there are links between behaviour when using avatars could negatively impact their ability to emphasise and recommended this as an area needed further exploration. The value of this is clear because some of today's children will become the healthcare professionals of the future and therefore the ability to practice empathetic behaviours may become increasingly important. Other research into empathetic response in the virtual environment has found that empathetic responses are complex and the success of teaching empathy will be related to a variety of factors (Bertrand et al. 2018). These were said to include variables such as altruism, self-awareness and awareness of others as well as relationships between observer and emoter. Gomes at al. (2018) supports the need for teaching clinical skills for humanisation of care saying that this gives not only structure but also intentionality to the caring relationship thusly

increasing patient goodwill and health carer's job satisfaction. However, they also warn that this can be difficult to teach in the clinical environment due to on shift workload demands. Therefore, VRLE which support acquisition of these skills are of value as part of healthcare education.

Theme three – Identification with role / professional identity

Theme three encapsulates contributions that are irrevocably linked to all the other themes and contributes to answering research question two in particular. Competence in clinical practice ensures that patient care is appropriate to their needs and is safe, but it can be difficult to quantify whether this is adequate at point of registration for all newly qualified practitioners (Skirton et al. 2009, Department of Health 2010). There is a subtle difference between identification with the role of being someone who works in healthcare [providing healthcare] and professional identity [providing healthcare in a way which is relevant to your profession and the way you behave while doing so] (Hogg et al 2004; NMC 2018c; Wilkins 2020).

Identification with role requires the healthcare student and professional to work within their scope of practice, which it can be seen is irrevocably linked to professional identities (HCPC 2021b; NMC 2023b). For example, paramedics have a very different professional identity to midwives although both of their healthcare roles allow them to facilitate the birth of a baby (College of Paramedics [CP] 2021, NMC 2018c). However, paramedic professional identity and scope of practice means they would only do so as part of urgent or emergency care whereas by law midwives' professional identity and scope of practice means they must participate in the facilitation of all births, though their scope of practice will vary depending on the type of birth (NMC 2021).

For this reason, there are difficulties in facilitating consistent practice experiences for every student to support them to form identification with their role. Trying to ensure experiences which are equitable for the healthcare students as individual learners in order to develop the necessary professional identity adds layers of complexity. However, the move towards multidisciplinary healthcare teams as part of the NHS Long Term Plan will require healthcare professionals to work in different ways (NHS 2019). This could complicate adherence to clearly defined professional identities without pedagogy which straddles identification with the healthcare role in relation to professional identity (Academy of Medical Royal Colleges 2020). A study by Bradshaw et al. (2018) found that environments where student autonomy was safely possible, but with support still available, had a positive effect on competence and confidence. There remains difficulty in ensuring that this can be available to all students in clinical practice

and as often as needed by each individual to develop their confidence to the necessary standard without the availability of VRLE.

Within the safeguarding VRLE used in this research there were RPs from paramedic and midwifery disciplines (amongst others) and these were able to identify with their healthcare roles for safeguarding whilst maintaining their professional identity (Chapter 7, section 7.3). O'Connor (2015) states that use of VR for healthcare education related to application of key skills in the clinical contexts can augment and enhance clinical practice. This familiarisation with skills in turn could have a direct positive impact on the competence of student and future healthcare practitioners.

Contribution to knowledge:
The importance of VRLE for supporting healthcare students to develop their clinical intuition skills has been evident. The RPs felt also the use of VRLE enhanced their clinical confidence through practice opportunities (Chapter 6 – section 6.3.4.2 and Chapter 7 – section 7.3.1.1). The RPs believed that the VRLE also supported them to develop confidence in other clinical skills such as having challenging conversations (Chapter 7 – section 7.3.3.1). This was felt by all the RPs as students in their various healthcare disciplines– physiotherapy, public health, paramedic, nursing and midwifery students making these finding more generalisable than if the RPs had been from a single healthcare discipline. This research has shown that VRLE connect with the RPs clinical curiosity and also encourage reflection on their experience and learning (Chapter 7, section 7.6.3).

Evidence gathered from the RPs demonstrates that the VRLE offer experiences that triggered empathetic reactions from the RPs in response to the plights of the VRLE characters. Research from this project has evidenced that VRLE can offer students a place to experience these challenges, to consider the emotional impact, and discuss reasons why people may behave in these ways. Furthermore, VRLE offer a space to develop humanistic strategies for delivering care in the aforementioned situations as well as other coping skills before having to do this in actual clinical practice.

The RPs evidenced that the VRLE helped them to humanise their healthcare by supporting them to:
1. ask questions in a more direct way in order to identify individual healthcare needs
2. respect the different lifestyle choices people made
3. solidify their knowledge in order for them to put it into practice

4. improve their judgement calls about aspects of episodes of healthcare

There were variances of opinion between RPs at different levels of study, with the more senior students suggesting that the practice was useful to improve confidence or refresh knowledge after gaps in practice, but that the skills were not new to them. The more junior the RP was as a healthcare student, the more value they expressed in the VRLE's capability to teach them new skills as well as being a space to practice these. However, some concern was expressed that it may give more junior healthcare students less opportunity to practice their clinical intuition. Whereas other RPs disagreed with this and stated that the VRLE offered practice opportunities regardless of experience.

The question as to how deep or meaningful the learning experienced by the RPs in the VRLE cannot be fully answered by this research. Although their feedback appears to indicate that the RPs perceived that their learning was meaningful, data about the depth and longevity of their learning was not gathered. Researchers have proposed that if students are emotionally engaged with their VR learning then this will result in active engagement with the learning activity which in turn becomes deep and meaningful learning (Mystakidis et al. 2021). However other researchers argue that the engagement required for deep and meaningful learning can only be known if this is assessed (Gebreheat et al. 2022; Castaneda et al. 2023). I would agree that this requires exploration and that follow up is important in order to determine how deep and meaningful the learning has been in relation to longevity of skills learned. Therefore, it is a limitation of this research and one which would benefit inclusion in future research.

Polkinghorne et al. (2021 and 2023) developed a model to assess students' perception of their learning and although they did question the validity of self-evaluation, they highlighted that their model could be of use to determine what level of support would be of value to individual students. Others have suggested that this could be done effectively using algorithms so AI could be used to monitor for this whilst the students are immersed in the VR activity (Bhardwaj et al. 2021). It can be seen that this is not too far forward from the way AI is currently being used by learning institutions to monitor student engagement with online learning environments or the learning materials in virtual storage areas and by doing so are able to predict which student may be at risk through apparent lack of engagement with these areas of their learning institution (Waheed et al. 2020).

Social VR environments have been recommended to enhance the learning by providing students with spaces where they can meet and discuss their VR learning experiences (Mystakidis et al. 2021) which adds to the known importance and value debriefing can provide to a learning experience (Duff et al. 2024; Loomis et al. 2024).

Overall, it can be concluded that RPs believe the VRLE experience supports transferability of learning to clinical practice placements and therefore that the VRLE was a good tool with potential to be even better. As discussed, it can be seen from the RPs feedback that they believe that some improvements to the VRLE experience are required in relation to support in the form of feedback. This will be discussed in detail in question three and theme four section 8.3.3 which encapsulate the findings related to functionality.

8.3.3 Research question three

Research question three asked: To what extent does the VRLE functionality impact healthcare students' perception of their ability to engage with the given scenario?

This research question was answered by theme four which concentrates on impact of capacity, connectivity, navigation and information.

It is acknowledged that despite the value of action research, this collaborative research process does add complexity to the pace of the research and to the ethical considerations of the research project (Wiggins and Wilbanks 2019). This can be seen in theme four which, as discussed in Chapter Six (section 6.3.3.2) and seven (section 7.3.4), reflects on the functionality of the VRLE, frustrations experienced by the RPs in navigation within the VRLE, as well as the ethical implications of use of VRLE for RPs with poor or no connectivity which renders VRLE inequitable for them. For this research to progress to the next phase, action needs to be taken to address the inequities raised by the RPs.

The clarity issues were linked to older versions of the VRLE and the RPs who fedback on this did not have the most up to date version installed. The text font and feedback within the VRLE was amended for increased clarity in the highlighted places based on the feedback given. This also highlights the need for clarity of information provided to VRLE users in a comprehensive and contemporaneous way.

Contribution to knowledge:

Feedback by the RPs in this theme related to lack of individualised learning paths. In addition, they expressed a desire to have shared feedback sessions in class to

compliment the feedback which is provided within the VRLE. However, the RPs collective feedback to this aspect is fairly evenly mixed with some citing the feedback needed to be increased or enhanced in order to maximise the benefit it could provide and others stating they were satisfied with the feedback. This feedback limitation is in part directly related to the amount of funding available to spend on the build of the VRLE. With more funding the amount of general learning opportunities could be maximised because the story board could have additional levels of responses related to VRLE user choices. However, there would still remain a limit to which this could be fulfilled for each individual (Daden 2018).

Other aspects of navigation were also highlighted as posing challenges by the RPs. These included proximity to trigger points within the scenario visuals but this feedback also demonstrated that this was influenced to the device used by the RP, their familiarity with it and their competence with digital technology. As discussed, if the pre-action information had included more information about navigation and differences dependant on chosen device then these frustrations may not have arisen.

Connectivity and capacity were also raised as issues by RPs (Chapter 7 – section 7.3.4.2). The increased chance of inequity raised by these issues was discussed and is acknowledged as an important consideration going forwards.

8.4 Lessons learned

There were several interesting overall lessons learned which overall related to the design of the data collection and research instruments. These lessons learned have been grouped into the following categories: safe fails, the theory-practice gap, clarity issues, feedback, and managing the RPs' expectations.

8.4.1 Safe fails

Although this research explored ways in which minimising tutor involvement when applying theory to clinical practice within VRLE, there is a need to consider the benefits of aspects such as debriefing and what form the delivery of this should take. Michelet et al. (2020) found that when learning skills online, computerised debriefing significantly improved student's perception of their abilities with non-technical healthcare skills for neonatal resuscitation compared to those who had not received debriefing after online learning. However, it can be seen from this research's findings that this does not necessarily maximise the learning gains on offer.

As discussed in Chapter Seven (section 7.3.3.3), this research demonstrated that VRLE offered value in relation to a space to experience safe fails. However, it is important to recognise that safe fails when used as an unsupported resource may offer inadequate learning opportunities because the intended learning outcomes (ILOs) might be less than expected (Safarti et al. 2018). This was noted with the Parvell family VRLE which had Benny, the family's young boy asleep in a dog crate, with a dog also asleep in the crate (bottom left of Figure 43). However, the fact that Benny was in the dog crate did not come up as a collective learning aspect in the focus group discussions even though it was intended to be when I was writing the VRLE scenario.

Figure 43 - young boy in dog crate with dog.

The RPs noted all but this one of the safeguarding concerns independently though they said that they were aware of it once the VRLE's feedback alerted them to it. The RPs did learn from the feedback, but not to the extent that had been intended when I wrote the content for this VRLE. On reflection, the crate was placed too close to the party detritus. Also, in close visual proximity at this point in the scenario, as a result of the house being open plan, was the baby sleeping on the couch with an unidentified man. Therefore, in future action research this aspect needs to be amended to maximise the learning benefits that could be gained. It is expected that this could be achieved by changing the layout of the scenario and holding a multidisciplinary students' group debrief after VRLE use to discuss learning and address any gaps not accounted for by the VRLE feedback.

The value of debriefing after virtual learning sessions has been highlighted to be as important as traditional learning session debriefing (Gebreheat et al. 2022). The

PEARLS Healthcare Debriefing Tool framework design will help facilitators to maximise the benefits of this (Bajaj et al. 2021). Using this tool as a framework for debriefing would support healthcare students should they experience distress from any virtual or traditionally offered scenario, as well as ensuring that the person facilitating the debriefing has thought ahead about triggers which may be present in the scenarios prior to debriefing sessions. This can be seen to be a particularly important consideration for safeguarding and emergency care scenarios whether they are experienced in the traditional way in the classroom or skills lab or whether they are experienced virtually. Making these changes may also improve the benefits offered as part of bridging the theory – practice gap which is discussed in more detail next.

8.4.2 The theory – practice gap

The curricula differ between healthcare professions with some offering safeguarding specific teaching for each year of the degree and others offering much less (Appendix 7 - Y, L.139). Furthermore, the accessibility of experiences is not guaranteed and not always suited to what the individual student requires. In instances such as this, VRLE could help fill this gap between the theory and clinical practice opportunities. As a result, it could be argued that student satisfaction and patient safety could be improved as a result. However as discussed in Chapter Six it would be useful to repeat this quantitatively as a paired test. This would facilitate gaining more precise information about the benefits of bridging the theory -practice gap using VRLE by linking individual RPs through use of an anonymous token pre- and post-action.

8.4.3 Functionality

It can be seen that affordable, trouble-free user experience with VRLE is currently an unattainable goal with pioneering technology such as this was when this research project began. However, functionality issues such as lack of clarity of instructions and other information within the VRLE which have negatively impacted on the RPs user experience are likely to be the easiest to resolve in the short term, thus improving future user experience of VRLE. The VRLE did have a feature which made it relatively easy for people with basic app development skills to make ongoing edits. This meant the VRLE could be enhanced based on user feedback at the learning institution rather than by paying the technical architects of the development company which added to the appeal of the VRLE. Unexpectedly, the SME which had developed the VRLE have moved on from education to different areas of interest for them as a company, so these VRLE are no longer viable as there is no host platform for them to be accessed from. This was a situation which had not been expected at the beginning of this research and there were no plans in place to source an alternative host site. The university is currently looking at ways to increase the offer of alternative simulation experiences for

the students in a variety of ways from high fidelity mannikins to CAVES to 360 video to VRLE.

The NHS (2019) published results from four case studies on digital technology it had implemented from ill health monitoring and prevention to maternity care records. Other than this there is currently a dearth of publications related to usability testing performed by developers on digital health technology despite increasing use (Maramba et. Al 2019). However, it can be argued that in the future, usability testing and research projects such as this one will contribute to improved user experience and that going forwards this will be the standard which can be expected. Research projects such as this one are also providing feedback to drive use of digital technology for healthcare education forward. This exploration into digital technology for healthcare education has been highlighted as being of key importance for the modernisation of healthcare education and that this is urgently required to meet the changing needs of healthcare provision (Topal 2019). The RPs for this research have added to the body of knowledge around useability testing and their preference for feedback in a variety of ways linked to VRLE use is an important aspect of the useability.

8.4.4 Feedback provision

VRLE in the future need to address the issue related to RPs expressing a preference for detailed and individual specific feedback and opportunities for group discussion of VRLE experience. Ideally this should be offered as part of the VRLE itself for continuity of learning to be maintained. Recent research has suggested that hybrid environments which combine immersion in a scenario containing 2D and 3D along with projections of clinical notes onto writable surfaces is effective for behaviour change through learning (Salvetti et al. 2021). However, it is not apparent how cost effective this innovation would be as it would need to be situated in a clinical skills lab and resourced with appropriately trained educators rather than being a tool like the VRLE which students could use at a time which suited them and as often as they needed to. The need for feedback or debriefing sessions is clear both from this research data analysis as well as the conclusions from a recent attempt at creating a framework for use of immersive VR in education (Mulders et al. 2020). These researchers concluded that there is a need to ensure that the learners are engaging with the virtual environments, or the learning cannot be measured.

This aligns with the feedback from the RPs who stated that additional feedback, discussion or debriefing about the intended or expected VRLE learning would be a beneficial addition to their experience and this in itself could be a measure of their

learning. Research by Pedersen et al. (2021) demonstrated the value of use of online debriefing for interprofessional hybrid simulation sessions following which students also had improved attitudes towards working with multiple profession disciplines when providing emergency care. The value of this in relation to the multiagency working required for safeguarding care is clear and one which requires further exploration in order to compare the gains from traditional debriefing venues.

One further consideration that was highlighted during this research was the importance of managing RPs expectations in relation to what quality standard they could reasonably expect from the VRLE.

8.4.5 Managing expectations

The research has shown that the research participants found the VRLE beneficial to their learning overall, but that they also expected the technology to work without any glitches and for the avatars to mimic real life to a greater extent. At the time of planning and beginning this research VRLE were ground-breaking technology and as such they can pose challenges to both the learner and the teacher introducing the users to the technology. In hindsight this expectation could have been better managed pre–action and this may have improved their perception of their experience.

However, it is recognised that a delay in moving the scenario forward due to a lag in the wifi connection or too much demand from simultaneous users is akin to being interrupted in their learning, so their frustrations although unfortunate and in part preventable, are also understandable. Technology use has increased since the start of this research project, in part due to the recognition of the value it can add to providing healthcare, with transmission of infection kept to an irreducible minimum which expanded use out of necessity during the pandemic lockdowns (Da Silva et al. 2021). This in turn has increased familiarity, raised awareness of the need for reliable institutional broadband connectivity, as well as functionality.

The concerns that VR cannot be used to mimic real life interaction between humans, particularity the worries about missing the nuances of non-verbal communication, are ones which have been researched as part of other projects (Bertrand et al. 2018). Research has been conducted into the contagiousness of yawning in VR compared to affect in real life by Gallup et al. (2019). They concluded that although this can be affected in VR, the responses will not mirror those in real life because using VR technology available when this research was conducted means subjects are not fully immersed in the experience. Indeed, the purpose of using VRLE for this research was

not to replicate real life in the virtual environment or to make RPs fully immerse in the VRLE. Instead, the VRLE were an offer of a safe space to access clinical experiences with avatars that they felt they emotionally connected with enough for the healthcare episode experience to matter. As discussed earlier in this chapter, this can be seen to have initiated numerous requests for additional VRLE.

8.5 Moving forward – the potential arising from requests for more VRLE

McNiff and Whitehead (2009) described action research as a process which leads to change in an ongoing cycle. This was evidenced in theme three discussed in Chapter Seven where the RPs feedback showed that they had found the VRLE of twofold use. Firstly, for giving them a place to identify with their roles in relation to how they would conduct safeguarding care. Secondly it raised their awareness of where they wished to see changes in curriculums which they believed would support them to learn theory in an equitable way with other healthcare students.

During the concept testing in the phase zero data collection as well as the quantitative and qualitative data collection in phase one, there were requests for additions to the University's VRLE catalogue, both in relation to different topics and different pedagogical focusses. Suggestions included: communication skills within multidisciplinary working (Appendix 7 - B, L.113), non-emergency skills practice opportunities (Appendix 7 - T, L.121) and basic practical / technical skills practice (Appendix 15).

This desire for VRLE which offer space to practice clinical skills and care which require physical contact is clear. There has been research into this when used as 360 videos (Peres 2016), Virtual Worlds (Bailey 2012), e-Simulation (Kyaw 2019), VR simulation (Rourke 2020) as discussed in the literature review (Chapter Two). In relation to the above requests in can be seen that it would be worthwhile for a research project to explore whether the existing systems for student doctors and student nurses could be adapted to be useful to the general healthcare student population rather than profession specific as the concept testing urinalysis VRLE for this research is. For example, a VR trainer for epidurals which currently is for doctors only, could be adapted to teach the prep and assistance required for this procedure. Similarly, the venepuncture and catheterisation VR training would be useful to student midwives, student paramedics, student doctors and so on.

Healthcare education is currently challenged by lack of diversity in both clinical and academic environments and peer groups which can give rise to some students feeling marginalised. VR may be able to help to provide more diversity in avatars and scenarios in VRLEs in order to that foster inclusivity (Charania and Patel 2022; Churchouse et al. 2023; Noone and Murray 2024). Furthermore, there is increasing awareness of the need to be mindful of specific considerations of cultural and religious impact in providing holistic healthcare in order to improve equity in education and wellbeing (Knight et al. 2018; O'Brien et al. 2018; Alomair et al. 2020; Stubbe 2020; Barmania and Reiss 2021; Fair et al 2021; Mothers and Babies: Reducing Risk though Audits and Confidential Enquiries across the UK [MBRRACE] 2022; Crowe 2022; NHS Race and Health Observatory 2023; HEE ND; UN Sustainable Development Goals [UNSDG] 2023). There were indications that VRLE for safeguarding would benefit by being diversified to be able to support learning about the impact of culture and or religion on safeguarding aspects (Appendix 7 - R, L.112).

Recent research indicates that we are doing more harm than good when it comes to certain cultural aspects of safeguarding, such as having conversations around female genital mutilation (FGM) which may be increasing victimisation rather than improving safeguarding opportunities (Karlsen et al. 2019). The existing safeguarding VRLE scenarios could be adapted to incorporate cultural or religious theory and practice which would reduce the cost of building these and they could continue to be suitable for the general healthcare population rather than being made profession generic. Furthermore, they could be adapted to include multidisciplinary working as appropriate to the scenario.

The importance placed on being able to use VRLE so they could be guaranteed experience in practising skills for emergency and other specialist skills care, both of which will necessitate some degree of multidisciplinary working was raised by the RPs (Appendix 7 - J, L.122). The RPs are aware that the midwifery scope of practice is becoming increasingly specialised, as are most forms of healthcare.

Some researchers feel specialisation is a good way forward and that these roles are under-utilised (Casey et al. 2017; McLeish and Redshaw 2019). Others feel specialist roles have a place in healthcare but only as part of specialist care clinics which have a multidisciplinary allocation so there is collaborative ownership of the healthcare (Millington et al. 2019; Ikomi and Mannan 2022). Finally, there are others who are concerned that specialist practitioner roles will unfairly increase workload (Lawler et al. 2020; Osborne and Kerr 2021). Although opinions vary about clinical specialist roles

the fact that they are being introduced into the healthcare workforce is clear. Working solely in specialist roles will contribute to these clinicians deskilling in other areas of their healthcare profession (Barnfield et al. 2019). This could then contribute to a reduction in flexibility at times of staffing crisis such as the high levels of staff sickness absence resulting from the Covid–19 pandemic, so finding ways to reduce loss of skills are a matter of urgency for the healthcare teams and people they care for (James et al. 2019). It can be seen from this research that one way to reduce skills decline could be through access to VRLE as a form of CPD.

Branches formed during this research and what they contribute

As discussed in Chapter Four (methodology), action research can be used to develop and explore branches as part of the generative transformational process while the existing research is ongoing (McNiff and Whitehead 2010). This was the case for this research project where the concept testing prototype developed for phase zero was adapted for use as part of the midwifery timetables during the Covid-19 pandemic and a VRLE which focussed on an aspect of emergency care was created as part of the action research for this research project instead of using the remaining funds to develop the third safeguarding VRLE as originally planned. This VRLE was cocreated in collaboration with the lead for the midwifery emergencies unit. Although these two VRLE are not part of this main phase one research they have provided interesting contributions to the knowledge base and thusly are worthwhile of inclusion and discussion in this thesis.

The PPH VRLE (phase one, branch – Appendix 5) was designed and intended to offer an alternate but additional way to learn and apply theory to clinical practice. Like safeguarding experiences, PHH experiences cannot be otherwise guaranteed as part of clinical practice placements for all students during maternity or obstetric healthcare education. The PPH VRLE was intended as a complement to traditional educational pedagogy in the same way as the safeguarding VRLE for this research project. The main difference between the PPH VRLE and the VRLE used for this research project were that within the PPH VRLE it was almost immediately obvious what the healthcare concern was unlike the safeguarding VRLE where there were subtle nuances woven into the scenario to integrate use of clinical intuition and encourage autonomous decision making, with no time limit pressure imposed.

Whereas, within the PPH VRLE, the healthcare students were put under pressure of necessary time critical constraints due to only having a maximum of 12 minutes in which to save the woman's life before she died from blood loss. This mimics the

pressures of managing a severe PPH in clinical practice. See Appendix 11 for a one page excerpt of the story board. This included visible blood loss which increased during the VRLE scenario to the point that it was visibly and actively dripping off the mattress Figure 44) and pooling on the floor (Figure 45).

Figure 44 - Blood dripping off bed during the PPH VRLE.

Figure 45 - Blood pooling on the floor during the PPH VRLE.

The PPH VRLE asks healthcare students to follow set emergency procedures with no need for use of clinical intuition. The students can work as part of a healthcare team to save the woman's life, they can fill out the required paperwork and choose from medical supplies, treatments, various drugs and drug doses. This VRLE could also facilitate the practice of multidisciplinary communication because all the VRLE developed to date have an option for synchronous use. This is where several different people can be engaged in the scenario at the same time so in this case different students could take on the role of different healthcare avatars and work together to resolve the blood loss and save the woman's life. After analysing the data from this research, it can be seen that in addition to the safeguarding VRLE, the PPH VRLE could also be improved in similar ways. For example, adding aspects of how to communicate with the woman and her family after successful treatment of the PPH in

order to prepare them for the ongoing impact of the PPH in the postnatal period would be beneficial as also indicated by other research which has found that education about the impact of nonverbal communication during PPH is equally important (Briley et al. 2021).

The safeguarding VRLE expect students to use their interpretation of the situation as a whole to decide on what healthcare should be offered as the scenario plays out but this would be dangerous to do within the PPH VRLE where lifesaving action always needs to be started as soon as possible. So, although they are both VRLE, the learning opportunities within each are different. The PPH VRLE was generated to offer a different type of clinical experience through the transformation of the VRLE used for this research as part of the action research (phase one, branch).

An additional branch was generated during this research and this is the one which was influenced by the impact of the Covid-19 pandemic. Level 4 midwifery students were expected to have a clinical practice assessment as part of their learning expectations. This assessment was not possible while the Level 4 students were unable to engage in clinical placements due to the impact of Covid -19, including staffing levels and required measures to reduce transmission (HEE 2020a; HEE 2020b; Swift et al. 2020). This led to the repurposing of the concept testing prototype VRLE (phase zero – Appendix 5) during which the scenario focuses on skills required for antenatal examinations. The assessments for this portion of the Level 4 clinical skills unit while the Level 4 students were not allowed into clinical practice included use of the VRLE and data tracking of this use in order to ascertain whether they were clinically competent in the techniques required for urinalysis (phase zero, branch – Appendix 5). This supported these students to have vital clinical experience and for their education, although different than planned, to continue following the curriculum without interruption (Gadi et al. 2022). Additionally, this provided these Level 4 healthcare students with a sense of preparedness, predictability and reliability whilst their professional identity was in the early stages of development during a disruptive time in healthcare education.

8.6 Thematic connectivity to action research and recommendations for further research

8.6.1 Theme one - consideration of individual characters within the VRLE as a whole person

There is currently no scale for measuring humanisation of clinical practice. This research has demonstrated that VRLE can support humanisation of clinical practice.

Therefore, future research could include developing a scale to measure humanisation of care, for example by using the 6Cs in further research. As discussed in Chapter Six this research could be repeated quantitatively once the phrasing of the question was adjusted to more clearly convey the specific information needed from RPs for example using a 1-10 scale rather than a yes / no option. Additionally, this question should be explored further qualitatively, with as many focus groups as feasible, in order to gather enough data to generate findings which are generalisable to the general healthcare student population.

VRLE would also benefit from being able to portray the stress response of clients within the VRLE which may support the RPs to deepen their emotional engagement with the scenario avatars which may also increase their perception of their ability to humanise their healthcare within the VRLE. Additionally, it would be interesting to explore whether full immersion increases the impact of the scenario compared to partial immersion. Future action related to this could be to install a measure of the stress responses of the family member's avatars or to have the avatars facial expressions change based on their emotional response as a way to explore whether this deepens the healthcare student's emotional engagement and therapeutic response to the VRLE scenario. It would also be worth exploring whether full immersion increases the impact of the scenario in relation to the healthcare students' perception of humanising their healthcare within the scenario.

8.6.2 Theme two - Physiological manifestation of clinical intuition

The analysis of the data raised a question about whether clinical intuition practice benefits might vary depending on the level of study the healthcare students are in when using the VRLE. Further research into this with the RPs divided by level of study would be of value in offering insight into this. However, I do believe that intuitive ability and therefore individual confidence in intuition varies with individuals. Instances of very junior students having better connection with their feeling of intuition and intuiting hidden conditions more precisely than more senior students or even qualified professionals have been personally observed during my years of clinical practice. This is particularly observable in healthcare students who have previously worked in professions where intuition was a necessity (for example, policing) and they had come into their healthcare education with pre-existing confidence in their ability to intuit. Therefore, it should be noted that confidence in clinical intuition is a crucial factor and one which should be considered before the clinician's level of experience is treated as a deciding factor. So, if a further action were to take place exploring clinical intuition by level of study, then it might be more effective to ask RPs to state their level of

confidence in use of intuition and for this to tracked pre- and post-use of the VRLE. Moving forwards, it would be worthwhile ensuring the information provided was explicitly stated that the VRLE can be used to maximise the learning potential offered no matter what level of their degree they are at. VRLE have been shown by this research to be of value in supporting healthcare students to practice challenging conversations so a VRLE which include cultural aspects would be a worthwhile development for use by healthcare students.

8.6.3 Theme three - Identification with role / professional identity

Within this research requests have been made for VRLE specifically to address several important areas within healthcare: abuse linked to culture and religion, VRLE with more practical / technical skills such as for selecting the correct syringe or choice of onward referrals, multidisciplinary communication as well as multidisciplinary scenarios for PROMPT skills and emergency care scenarios (which would automatically offer practice with verbal and nonverbal communication). There appears to be a need for VRLE which offer practice opportunities for hard and soft clinical skills mixed into the same VRLE. This would more closely replicate clinical practice within healthcare outside of VRLE and therefore it is likely this would be of value as healthcare practice opportunities.

Although this research has evidence that the RPs believe safeguarding VRLE learning will have an onward positive impact on their clinical practice, it is not yet known whether emergency scenario VRLEs, where practitioners can make mistakes and deepen learning without any risk to patients in real life, will also transfer into improvements in their clinical practice (Mulders et al. 2020). To understand this, the PPH and other emergency scenario VRLEs need to be user acceptance tested (Maramba et al. 2019), transfer of learning into clinical practice needs assessing (Kyaw et al 2019) and further research needs to be undertaken to ensure that VRLE for different aspects of healthcare will also be beneficial for learning and skills practice (Kononowicz et al. 2019). From the RP feedback on VRLE subject requests in the concept testing (phase zero, Appendix 15) and feedback from this main phase of the research (phase one, Appendix 7) it is evident that many more are desired, each with a specific complexity of care. It is important that consideration is given to the benefit of actioning the requests for other VRLE.

However, it is important to note that there is already research which has been completed since I began my own research. The increasing interest in and use of VR and mixed reality (VR and augmented reality) have improved realism, including true –

to – life avatars being used for armed forces medical training and more (BLUEROOM 2023). I would argue these improvements has also had an unfortunate knock-on effect of increasing production charges, access fees and maintenance costs of VRLE rather than a reduction in these as I had expected at the beginning of this research which means that a status quo remains (Wong et al. 2021). Research has been undertaken to explore the value of using mixed reality for healthcare pedagogy and the value of this has been evidenced (Phillippe et al. 2020; Mousavi et al. 2022; Tang et al. 2022). A small study (n=19) by Adhikaria et al. (2021) evidenced the value of using VR for learning clinical skills and recommended that further research was done in relation to the potential learning gains from a combination of using HFSM and VRLE. Additionally, it would be of value to include traditional clinical practice placements in future research, as well as exploring the longevity of retention from this learning, transferability to healthcare practice and whether the order these are used to provide learning opportunities have an impact. Gathering data to provide answers for these aspects would further contribute to the body of knowledge for healthcare education.

Additionally, consideration needs to be given to the advances with AI use in healthcare and whether future VRLE need to incorporate opportunities to apply theory to clinical practice in deployment of AI assisted technology in use with diagnostic and other healthcare provision (Topal 2019; Kuwatti et al. 2023). Teng et al.'s (2022) research demonstrated that healthcare students have made it clear that there is an expectation that AI literacy should become part of their curricula. It has been stated that the healthcare educator's role is crucial in the development of AI whether it is used for healthcare education or for deployment of healthcare itself (Masters 2019). In addition to this I argue that the importance of healthcare educators in the nurturing and development of future healthcare clinicians is a key contribution regardless of the platform which is used to create the pedagogy and deliver the education.

Rather than continually redoing work on healthcare education, I suggest it would be beneficial to healthcare researchers and students to create a shared library of resources that could be either open access, copied, adapted or even licensed for use with intellectual copyright protected in a similar way to authors of articles.

RPs from this research asked for VRLE on multidisciplinary communication, however a VRLE which focussed on initiating challenging conversations and conflict resolution between healthcare professionals has already been developed and researched as have other VR healthcare education packages as discussed in Chapter Two. These types of resources with existing evidence of effectiveness could be adapted to include

other types of multidisciplinary conversations which may be challenging for various reasons such as in complex, urgent or emergency care thusly expanding the existing resource for the benefit of all healthcare students' education and professionals' CPD. This adds further weight to the argument for shared VRLE healthcare education resources.

Furthermore, future research would benefit from pairing the RPs pre-and post-action using a linking token which would allow them to remain anonymous but also to facilitate comparison of commonalities and outlier data. Finally, it would enrich the findings from this research as well as future research if these research results, which have been generated by healthcare students' use of VRLE, were compared to those of healthcare professionals when using the same VRLE for CPD.

8.6.4 Theme four - Importance of functionality

Research has determined that the prevalence of mobile phone ownership in developed countries is at a high level with ownership ranging between 80% in the UK and the US to 100% in Saudi Arabia and South Korea (Latif 2019). Research undertaken on a range of health professions indicated that lack of internet access was more of an educational hinderance thank lack of smart phone (Curran et al. 2019). However, this research was done with qualified Canadian professionals undergoing CPD and are therefore likely to be in a better financial position to afford a smart phone than the average healthcare student. It is recommended that research is undertaken to determine the prevalence of smart phone ownership amounts healthcare students in the UK and the prevalence of those phones which have the capacity to store and use VRLE. This will contribute to knowledge of whether the ongoing development of VRLE is accessible to healthcare students and therefore financially feasible for the universities to create, implement and maintain. Action research could continue in this aspect by exploring ways in which the VRLE could support these changes so that the additional theory could be provided without increasing demand on students and staff. Further cycles of this action research could increase the knowledge base about the impact of using VRLE for healthcare education. Changes can be made to pedagogy delivery and clinical practice placement experiences that cannot otherwise be guaranteed.

The VRLE in the future need to address the issue related to RPs expressing a preference for detailed and individual specific feedback and opportunities for group discussion of VRLE experience. In particular, it is recommended that exploration is undertaken to see if this could be done in the virtual space and whether it could be

done as a multidisciplinary forum. This could support future proofing healthcare education's clinical practice access impact of any future pandemics. Finally, looking forwards and taking into consideration the advancements in AI discussed on page 215 (student engagement monitoring) and page 229 (teaching healthcare students how to use AI healthcare technology as part of their scope of practice), recent studies have argued that it is probable that AI could be participating within VRLE in the near future (Shanker 2022; Lakshminarayanan et al. 2023; Wang et al. 2023). AI technology could monitor student's engagement and responses, determine if there are any recognisable negative emotional expressions and signpost appropriately. In line with the former AI could also provide additional VR experiences to bridge noted gaps in healthcare students' learning thus further reducing inequity in learning experiences, or to assign them to sessions in the skills labs for hands on practice with HFSM which could be enhanced by AR as required to make their non-VR learning more immersive.

8.7 Conclusion

Becoming better skilled healthcare professionals and using evidence–based practice to improve the healthcare experiences and lives of others is a philosophy dear to the heart of all healthcare students and clinicians (Melnyk and Fineout-Overholt 2022; Peate and Hill 2022). It can be seen from this research that the VRLE have improved leaner experience and that the RPs believed this virtual learning would transfer into their clinical practice.

The VRLE have offered RPs safeguarding experiences which cannot always be guaranteed, particularly not during covid-19 pandemic when students were removed from clinical practice for a number of weeks. The VRLE also reduced the pressures on the theory and clinical teaching and assessing team in comparison to traditionally taught (on campus) theory and (practice based) clinical experience.

Improvements were made to the VRLE based on RP feedback during the concept testing (phase zero), then based on feedback from clinical colleagues prior to research for this project. This also led to development of a PPH topic VRLE based on feedback from RPs during the main research (phase one). Each iteration included adaptations based on RP feedback.

For the research process to be validated and contribute to changes to existing pedagogy these outcomes would be expected to be put into practice by the researcher as well as students / colleagues. In this way this research project will contribute to

offering solutions to current and ongoing problems with providing clinical experiences which cannot otherwise be guaranteed.

There is a need to make learning available as partially immersive and fully immersive VRLE as well as the more traditional paper, role play and simulation formats in order to facilitate healthcare student learning to occur in a variety of ways which complement each other. However, the paper, role play and HFSM versions do not facilitate learning and practice of clinical intuition as evidenced by the qualitative feedback discussed in Chapter Seven.

This research has shown that VRLE offer an effective space for healthcare students to practice both hard and soft clinical skills as part of their learning package though this can be enhanced by ensuring functionality issues are at an irreducible minimum. VRLE also offer a space to experience clinical circumstances and interactions which cannot always be otherwise guaranteed as part of healthcare education and standard clinical practice.

In addition to VRLE being welcomed by healthcare students, there are early indications that they will also be of use for healthcare professionals as a space for CPD and that the VRLE have potential to influence national policy as discussed in Chapter Five.

Healthcare students and healthcare professionals who are confidently skilled offer more effective and safe care which will in turn better the lives of the healthcare service users. The data from this research has shown that VRLE can be of benefit to both healthcare pedagogy and healthcare education in a generalisable way and that healthcare students believe VRLE can have a positive impact on their healthcare provision. This research has demonstrated that VRLE can be created which support students of numerous healthcare professions to learn from clinical experiences which cannot be otherwise guaranteed and that within the VRLE they can practice various clinical skills including clinical intuition.

It is not intended that VRLE should replace traditional teaching, but instead they are expected to support learning institutions to offer healthcare students experiences and opportunities to plan care and develop skills in realistic environments which cannot be guaranteed during the course of their studies. In addition to this, CPD is a requirement of the NMC (2021) for qualified healthcare professionals. VR is already being used in some aspects of healthcare provision, for example in offering healthcare to those in hard-to-reach areas. In support of this, the WHO (2019) state that midwives who are

educated to international standards save lives and resources, but educators lack skills, access to clinical sites and training materials. Therefore, being able to offer VRLE to qualified healthcare staff would also be of benefit particularly in respect of realistic experience with practising clinical care in relation to safeguarding children, domestic abuse, mental health, emerging concerns and clinical emergency scenarios.

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Appendix 1: Maternal and Childhood Obesity standalone distance learning resource unit specs and information leaflets

MATERNAL AND CHILDHOOD OBESITY (MaCO)

Level: H

Credit value   20   (ECTS 10)

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PRE-REQUISITES AND CO-REQUISITES

None

AIMS

To develop the underpinning knowledge and skills required by healthcare professionals and others involved in the care of women and children in relation to weight risk assessment and providing support with lifestyle changes.

INTENDED LEARNING OUTCOMES

Having completed this unit the student is expected to:

1 Have an understanding of the psychological and physiological implication of being overweight or obese

2 Have the intellectual and professional practice skills required to effectively manage challenging conversations in relation to weight and lifestyle choices

3 Appreciate the component parts that require competent completion when undertaking weight related risk assessments

4 Be intellectually and professional prepared to advise clients on personal lifestyle changes and local action programmes

5 Be active in reviewing / auditing personal and local services regarding women and children's adaptation of lifestyle and sustained behavioural modifications

LEARNING AND TEACHING METHODS

The unit will be delivered as a stand alone self managed course of study during which the learner will be engaged in a variety of guided activities delivered in a variety of teaching methods including podcasts, vodcasts, workbook based activities, consideration of flowcharts, graphs and illustrations incorporating an extensive range of web and text based resources The web platform that this unit is provided in has been used successfully for other units of study.

ASSESSMENT
Summative Assessment:
- ILOs   will be assessed by coursework equivalent to words; 100%

- ILOs   will be assessed by coursework equivalent to 0 words; 100%
-

Indicative Assessment Information:
- ILOs will be assessed by course work compiled via:
  - Students will required to complete a web based workbook
  - Students will be required to complete an MCQ

INDICATIVE CONTENT
- Topic 1 : Review of pre-existing knowledge
- Topic 2 : Weight / fat proportion assessment tools
- Topic 3 : Psychological implications of obesity
- Topic 4 : Pre-conceptual support
- Topic 5 : Antenatal, Intrapartum and Postnatal care
- Topic 6 : Perinatal and childhood issues

INDICATIVE LEARNING RESOURCES

http://hsc4u.bournemouth.ac.uk/maco/index.asp?

NICE. Obesity: The Prevention, Identification, Assessment and Management of Overweight and Obesity in Adults and Children. London: NICE; 2006.

Butland B. Et al. Foresight.Tackling Obesities: Future Choices - Project Report. 2nd Edition ed., Government Office for Science, Department of Innovation Universities and Skills; 2007.

Centre for Maternal and Child Enquiries (CMACE). Saving Mothers' Lives: reviewing maternal deaths to make motherhood safer: 2006–08. The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. BJOG 2011;118(Suppl. 1):1–203.

MATERNAL AND CHILDHOOD OBESITY (MaCO)
Version 1

Level M

Credit value 20   (ECTS equivalent credit value 10)

PRE-REQUISITES AND CO-REQUISITES
None

AIMS
Enable the student to reflectively enhance their pre-existing knowledge on the topic of obesity and analytically review the significance from multiple perspectives including; the individual, service, society.

INTENDED LEARNING OUTCOMES
Having completed this unit the student is expected to:

1. Have an analytical and reflective understanding of the psychological and physiological implication of being overweight or obese.

2. Be able to effectively facilitate challenging conversations in relation to weight and lifestyle choices showing emotional intelligence

3. Be conversant with the personal and professional competencies required to perform appropriate weight related risk assessment.

4. Be intellectually and professionally able to advise clients accordingly on lifestyle changes including signposting them to local action programmes.

5. Engage in personal and local service review that audits the sustained behavior modification of women and children under your care. .

6. Demonstrate an analytical and sensitive awareness of the resource implication posed by rising levels of obesity and complex problem solving solutions regarding, individual, community based solutions.

7. Prepare a paper for publication that focuses on ILO 6 and analytically explores learning from the other ILOs.

LEARNING AND TEACHING METHODS
The unit will be delivered as a standalone self managed course of study during which the learner will be engaged in a variety of guided activities delivered in a variety of teaching methods including podcasts, vodcasts, workbook based activities, consideration of flowcharts, graphs and illustrations incorporating an extensive range of web and text based resources The web platform that this unit is provided in has been used successfully for other units of study.

ASSESSMENT
Summative Assessment
ILOs 1 - 5 will be assessed by coursework equivalent to 2500 words: 50%
ILO's 6 - 7 will be assessed by coursework equivalent to 2500 words: 50%

Indicative Assessment
- Students will be required to write a reflective and analytical review of personal and professional learning and development enabled by completion of the web based work book covering 8 topics and MCQ.

- Students will be required to write an article for potential publication.

INDICATIVE CONTENT

- Topic 1 : Review of pre-existing knowledge
- Topic 2 : Weight / fat proportion assessment tools
- Topic 3 : Psychological implications of obesity
- Topic 4 : Pre-conceptual support
- Topic 5 : Antenatal, Intrapartum and Postnatal care
- Topic 6 : Perinatal and childhood issues
- Topic 7 : Developing a holistic approach to obesity management in the real world
- Topic 8 : Myth busters and top tips

INDICATIVE KEY LEARNING RESOURCES
http://hsc4u.bournemouth.ac.uk/maco/index.asp?

NICE. Obesity: The Prevention, Identification, Assessment and Management of Overweight and Obesity in Adults and Children. London: NICE; 2006.

Butland B. Et al. Foresight.Tackling Obesities: Future Choices - Project Report. 2nd Edition ed., Government Office for Science, Department of Innovation Universities and Skills; 2007.

Centre for Maternal and Child Enquiries (CMACE). Saving Mothers' Lives: reviewing maternal deaths to make motherhood safer: 2006–08. The Eighth Report on Confidential Enquiries into Maternal Deaths in the United Kingdom. BJOG 2011;118(Suppl. 1):1–203.

Maternal and Childhood Obesity (MaCO)

MaCO is a Bournemouth University distance learning package designed to enable clinicians and health care workers to develop the underpinning knowledge and communication skills required to confidently discuss the health risks associated with obesity. MaCO uses a range of different resources to suit all learning needs, is easy to follow, can be done at your own pace and in your chosen place thus enabling you to help women and children under your care make and maintain healthier lifestyle choices.

Who is this for?

- Midwives, General Practitioners, Health Trainers, School Nurses , Practice Nurses, Childrens' Centre Workers, Nursery Nurses, Public Health Practitioners

Efficient and Accessible

- Free for all those who provide health care to women and children in Portsmouth
- Easy to use and navigate
- Resources to use during and after your time spent studying MaCO
- Bite-sized elements which can be completed at your own pace in your chosen place

Content

- Introduction to the Public Health aspects of obesity including current research and guidelines
  Weight / fat proportion assessment tools and health risk assessment tools
  Psychological impact of obesity
  Pre conceptual support
  Physiological impact of obesity in relation to antenatal, intrapartum and postnatal care
  Perinatal and childhood weight management issues
  Developing a holistic approach to obesity management
  Myth busters and top tips
  Weight and lifestyle risk assessment resources
  Workbook
  End of MaCO learning package assessment
  Beginning and end evaluation of learning

Public Health Outcomes

- Best start for all
- Reduction in childhood obesity
- Improvement in maternal health outcomes

For Portsmouth related queries please contact:

Sue Hack - sue.hack@bodymorph.co.uk or Clare Hencken - clare.hencken@bodymorph.co.uk 023 9283 1720

Appendix 2: NoObesity app launch materials

Family NoObesity App

SUPPORTING FAMILIES TO MAKE HEALTHIER LIFESTYLE CHOICES

THIS APP HELPS

- families set health goals, including identifying barriers and strategies when the goals feel out of reach.
- allow progress on health goals to be recorded and includes links to parenting tips for extra advice and support.
- equip families to manage their own wellbeing as part of the work to prevent children becoming overweight and obese.

Download the App today at Google Play or App Store Search - NoObesity

Professional NoObesity App

SUPPORTING FAMILIES TO MAKE HEALTHIER LIFESTYLE CHOICES

THIS APP HELPS

- health and care professionals to provided tailored advice to families that includes tracking goals, barriers and progress.
- support families and health and care professionals in preventing children becoming overweight and obese.

Download the App today at Google Play or App Store Search - NoObesity

NoObesity

The Family and Professional apps can be linked so families can share their progress with a health and care worker.

Equipping families to manage their own wellbeing is part of the work to prevent children becoming overweight and obese.

Download the Apps today at Google Play or App Store. Search for NoObesity

Appendix 3: Categorisation of literature review papers and data extraction table

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
Adhikari et al. 2021 A mixed-methods feasibility study to assess the acceptability and applicability of immersive virtual reality sepsis game as an adjunct to nursing education	Nepal and the UK	Mixed methods – quant and qual	19 nursing students	Useful as an addition to traditional simulation Increased RP's confidence and decreased their anxiety for role in sepsis care	Ways VR is used in healthcare education Student acceptance Small number of RPs limits generalizability
Bai et al. 2012 The added value of 3D simulations in health care education	SL (virtual) and USA	Mixed methods - Likert scale and open-ended questions plus pre and post knowledge test	33 interdisciplinary students from occupational therapy, physical assistant and nursing students	Grant funded. Profession specific clinical skills practice for one day. All students rated their collaborative educational experience as a positive one and preferred the VR experience to the traditional printed case study.	Ways VR is used in healthcare education Student acceptance Affordability of VR
Bailey 2012 The age of virtual learning	SL (virtual) and England		Virtual maternity ward for labour communication skills practice	open access to island the ward was built on	Ways VR is used in healthcare education
Cobbett and Snelgrove-Clarke 2016 Virtual vs face to face clinical simulation in	Canada	Randomised pretest-posttest design	56 BSc nursing students	Asynchronous Student knowledge gain and self confidence labels are equivalent	Ways VR is used in healthcare education Student acceptance of VR use in

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
relation to student knowledge, anxiety, and self confidence in maternal – newborn nursing				with virtual and face to face simulation. Tech issues The benefits of virtual simulation is the number of times a student can repeat the simulation.	healthcare education Affordability of VR Contribution of VR to healthcare education – no significant difference and may be a promising way forward
Duff et al. 2016 Online virtual simulation and diagnostic reasoning	Canada	Scoping review	VR to support students to learn skills for heart murmurs and breath sounds which cannot be done with patient actors	Vr simulation was = / < traditional simulation with improved student engagement, safe easily accessible learning environment.	Ways VR is used in healthcare education Student acceptance of VR use in healthcare education Contribution of VR to healthcare education
Foronda et al. 2016 Evaluation of vSim for nursing	USA	Mixed methods - Qualitative (questionnaires) with a facilitator led 20-minute debriefing	120 BSc nursing students	Participants trialed vSim. Most found the product easy to use, a positive experience and recommended it for further use. Recommended further research to identify which applications would be of most benefit in comparison to manikin based simulation.	Ways VR is used in healthcare education Student acceptance of VR use in healthcare education Affordability of VR Contribution of VR to healthcare education
Gebreheat et al. 2022 Effectiveness of Digital Simulation	North America, UK, Europe and Asia	Literature review	10 studies with a range between 14 – 166 RPs and 795 student nurses in	Digital simulation has a positive impact on knowledge	Ways VR is used in healthcare education Global reach

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
on Student Nurses' Knowledge and Confidence: An Integrative Literature Review			total over the 10 studies.	and confidence None of the studies evaluated cost of VR vs benefits	Supports learning as individuals
Gentry et al. 2019 Serious Gaming and Gamification Education in Health Professions: Systematic Review	"high income countries"	3634 RPs in total for 30 RCTs	Individual profession research - medical students, nursing students, speech and language students, dental students (also some on CPD for doctors, nurses, paramedics)	Gamification of learning vs traditional pedagogy various degrees related to impact including improves knowledge, clinical skills and satisfaction with learning but quality of evidence or analysis evidence was decided to be of low or poor in many of the studies reviewed due to imprecision and inconsistency of skills being learned and future research needs to be more robust	Global reach Could transform healthcare pedagogy Contribution of VR to healthcare education
Goldsworthy 2022 The impact of virtual simulation on the recognition and response to the rapidly deteriorating patient	Five universities in 4 countries Canada, Scotland, England, Australia)	RCT Pilot = 44 nursing students 88 nursing students Control group = 34 Intervention group = 54 Mixed methods	Asynchronous VR simulations of clinical skills for healthcare in patients with acute / rapid clinical deterioration 20 question MCQ Zoom	VR can improve cognition and confidence when caring for rapidly deteriorating patients VR supports teaching during pandemics to	Contribution of VR to healthcare education Link between VR and subsequent patient safety

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
among undergraduate nursing students		Quant and Qual	based focus groups Covid pandemic impacted recruitment target of 120 nursing students	provide meaningful education using VR only when necessary such as when traditional clinical practice and observation is not available	
Gray et al. 2022 The impact of three-dimensional visualization on midwifery student learning, compared with traditional education for teaching third stage of labour: a pilot randomised controlled trial (2022) (and) The impact of three-dimensional visualization on midwifery student learning, compared with traditional education for teaching third stage of labour: qualitative findings of a pilot randomised controlled trial (2023)	Australia	RCT 38 midwifery students. 20 to control group and 18 to intervention Quantitative findings published 2022 Qualitative findings published 2023	MCQ and 6 via individual interview	Good for knowledge acquisition but concern over value offered for application to clinical practice as well as difficulties it may present for students for whom ESL Retention not measured beyond immediate research period. Too few RPs for findings to be generalizable	Ways VR is used in healthcare education Contribution of VR to healthcare education Small number of RPs limiting generalizability Mixed methods

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
Irwin and Coutts 2015 A Systematic Review of the Experience of Using Second Life in the Education of Undergraduate Nurses	Australia	Systematic review	Establishes current ways in which Second Life is used to teach healthcare students	Despite limitations such as communication lags, Second Life may be valuable in providing education alongside traditional methods.	Ways VR is used in healthcare education

Contribution of VR to healthcare education |
Kyaw et al. 2019 VR for Health Professions Education	Various	Systematic review	N/A	VR has the potential to transform health professions education. VR shows potential to improve postintervention knowledge and skills. Further research required to evaluate effectiveness of VR with high interactivity compared to VR with lower interactivity.	Ways VR is used in healthcare education Student acceptance of VR use in healthcare education Affordability of VR Contribution of VR to healthcare education
McGhee et al. 2011 Immersive virtual reality: potential seen in an undergraduate nursing and midwifery programme in Scotland	UK	Peer reviewed discussion paper	N/A	Immersion can support competencies for technical skills but more work is needed for immersive experiences to facilitate learning interpersonal skills.	Ways VR is used in healthcare education Contribution of VR to healthcare education
Mousavi et al. 2022 Effects of Virtual Reality	Iran	25 RPs RCT Quantitative	Anesthetist residents (1st year of a 4 year training programme)	VR learning outcomes are markedly improved compared to	Link between VR and subsequent quality of healthcare

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
Technology on Knowledge, Attitudes, and Skills of Anesthesia Residents			Intervention group (VR and clinical environment) = 16 reduced to 11 RPs Control group (Trad clinical environment) = 17 reduced to 14 RPs Impact of covid reduced number of RPs by 8 in total (see above)	those who learned using to traditional methods. Concern raised over cost of VR. Clear link to the importance of combining VR and traditional education Traditional clinical practice based learning (see one, do one) is insufficient when compared to combining it with VR	Value of VR when pandemic limits availability of traditional teaching techniques
Padilha et al. 2019 Clinical virtual simulation in nursing education Results similar to: Tschannen 2012 Sperl-Hillien 2014 Tifany et al. 2016	Portugal	RCT investigating knowledge retention, clinical reasoning, self-efficacy and satisfaction 42 RPs Quantitative	Nursing students split into two groups using – either a virtual simulator or a high-fidelity simulator Knowledge, reasoning before after and two months later with t/f and mcq. Levels of satisfaction and self-efficacy were assessed with a Likert scale after the interventions	Virtual simulation group made more significant improvements in knowledge after and two months later and higher levels of learning satisfaction. No discernible differences in self efficacy perception.	Ways VR is used in healthcare education Contribution of VR to healthcare education
Ryan et al 2022 Learning outcomes of immersive technologies	Germany, New Zealand, U.S.A., Portugal, France,	29 RCT involving 2722 RPs VR, Augmented and mixed reality	Medical and nursing students fire safety, clinical skills and A&P	Learning gains are equal to that gained from traditional learning and	Ways VR is used in healthcare education Contribution of VR to

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
in health care student education: systematic review of the literature	Singapore, Canada, Australia, Taiwan, Norway, Thailand, Slovenia, Switzerland, Norway, The Netherlands			student satisfaction and motivation to learn increased	healthcare education Student acceptance of VR use in healthcare
Rourke 2020 How does virtual reality simulation compare to simulated practice in the acquisition of clinical psychomotor skills for pre-registration student nurses? A systematic review.	USA, Kuwait, Turkey UK	9 Mixed method studies systematic review – nursing students	nursing students' clinical skills	VR leads to outcomes which are similar or superior to traditional simulated practice. Further research required to justify cost of investment. Increase in post intervention knowledge, cognition, performance and success of clinical skills demonstration Concern raised over cost of VR and variation in type of VR used in the research reviewed. Commented on lack of research in VR for acquisition of non-technical healthcare skills	Ways VR is used in healthcare education – catheterisation, venepuncture, airway management nontechnical skills Contribution of VR to healthcare education - not used enough for this to be assessed

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
Samosorn et al. 2019 Teaching airway insertion skills to nursing faculty and students using virtual reality	USA	Mixed methods - Questionnaires and open-ended comments – these were broken down into categories (+ve, suggestions and quality control comments).	21 students	VR can be used as an intervention in nursing education. Long term knowledge gains need to be assessed.	Ways VR is used in healthcare education – airway intervention Student acceptance of VR use in healthcare education Contribution of VR to healthcare education
Schindler et al .2017 Computer-based technology and student engagement: a critical review of the literature	Various	Systematic review of tech which had multiple studies undertaken related to student engagement Quant and Qual Sample sizes mixed but overall described as small	36 studies on social networking 14 on digital games (cognitive and emotional) 7 on wikis 6 on blogs and web-conferences Extrinsic motivation (such as grading) in influential	Multiple indicators of student engagement with most of the tech (social media allowing for unlimited number of characters, digital games and web-conferences but less so for blogs, wikis and other social media) Digital games provide most authentic learning and were reported to be more "fun" Security issues raised Some social media not available in some countries (such as China) More research required into cognitive indicators	Student acceptance of VR use in education Affordability Functionality Motivation

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
				such as motivation and persistence Degree of higher-order thinking and engagement influenced by level to which instructions are written	
Sperl-Hillien 2014 Educating resident physicians using virtual case-based simulation improves diabetes management : a randomized controlled trial	USA	Performance assessment using RCT	341 PG resident physicians	VR improved clinical skills management and confidence	Ways VR is used in healthcare education – diabetes intervention, BP, blood analysis Student acceptance of VR use in healthcare education Contribution of VR to healthcare education
Ustun et al. 2020 Virtual reality in medical education	Turkey	Quantitative - Questionnaire	421 university students	Student acceptance and use of VR tech in med education are high	Ways VR is used in healthcare education – operating skills Student acceptance of VR use in healthcare education Contribution of VR to healthcare education – social recognition of course desirability / prestige in Asian countries

Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
White 2016 Empowering medical personnel to challenge through simulation-based training	England	Thesis	Two phase research (5 months apart) 58 took part in phase one and 22 also participated in phase two	VR is a tool that is impactful in decision-making training and may have value for other aspects such as resuscitation. There were issues with expectation of the participants in respect of gaming knowledge and fidelity of exercise material	Ways VR is used in healthcare education – soft skills, used measurements to follow users eye direction to measure responses to consultant p.277 Student acceptance of VR use in healthcare education Contribution of VR to healthcare education
William et al. 2016 Traditional Instruction Versus Virtual Reality Simulation: A Comparative Study of Phlebotomy Training among Nursing Students in Kuwait	Kuwait	Quasi-Experimental Comparative study	Compares phlebotomy training and performance using traditional methods and virtual reality simulation method	Both methods equally effective	Ways VR is used in healthcare education - phlebotomy Student acceptance of VR use in healthcare education Contribution of VR to healthcare education
Williams et al. 2018 Consideration of using VR for teaching NNR to midwifery students	Australia	Scoping lit review - Issue for debate	N/A	VR can provide a safe environment to practice clinical skills but consideration needs to be given to risk of impacted fidelity, lack of engagement by users over time, technical	Ways VR is used in healthcare education – NNR, safe fails Student acceptance of VR use in healthcare education Contribution of VR to healthcare education

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Author and paper title	Location of research	Methods used / Study design / intervention	Relevance to Healthcare Education / number of research participants / healthcare professions being studied	Key Findings / conclusions	Theme
				issues and maintenance / update of technology.	
Wu et al. 2022 A pediatric seizure management virtual reality simulator for nursing students: A quasi-experimental design	Northern Taiwan	Asynchronous VR simulated clinical space three-hour VR session (20 min of introduction, 130 min for all students (in turns) to complete the tutorial and VR, and 30 min of debriefing using Diamond structure)	Paediatric nursing students randomly allocated into intervention (53) or control (52) group (in class lecture) Quantitative method with large group (53) debriefing	Post intervention knowledge was significantly higher in the intervention group Technical issues can impact knowledge grasp Large group debriefing may impact negatively Intervention positively received	Contribution of VR to healthcare education Student acceptance of VR use in healthcare education Functionality

Appendix 4: methodologies considered and rejected

Methodology	Reason for rejection
Narrative inquiry	More suitable for research with patients to gain their opinion on healthcare provided after VRLE used by students.
Feminist approach	Whilst this is a useful approach for discovering ways to drive change within societal behaviour, this research is not investigating women's experiences in relation to making those types of change.
Grounded theory	The usefulness in gathering themes from analysis of transcripts without the need to make data fit an existing model is a reason why grounded theory was initially considered as a possible approach however this has now been discounted in favour of action research which supports the dynamism needed for my research process.
Ethnography	With contemporary ethnography the researcher must be able to suspend disbelief and adopt a sceptical attitude towards that which is being said by the research participants, and this will be difficult to do when researching in a profession that I am currently a member of and in a field in which I am employed, thus this approach has been discounted.
Phenomenology	This is used to define the RPs individual understanding or experience of the phenomenon rather than the way the RPs collectively understand or experience the phenomenon.

Appendix 5: Elements of each action research phase displayed as a diagram, text and a table

Elements of each action research phase displayed as a diagram:

In the diagram below, phase zero which is highlighted in grey was part of my work as an academic, practitioner and researcher that led me to begin my doctoral research. Phase zero is not part of my doctoral research but was an important step towards it. Phase zero, as an essential pre-research study on VRLE use for urinalysis, allowed me to test a version of the intervention tools used for this doctoral research and to practice my conduct as a researcher.

The action research cycle of my doctoral thesis is comprised of two safeguarding VRLE, is referred to as phase one and is highlighted in cyan. This phase is the VRLE which are profession generic and topic specific. Phase one VRLEs for safeguarding offer healthcare students to experience clinical situations, assess, plan and implement care which cannot be guaranteed as part of their clinical practice placements.

In addition, there were two branches that formed, one in phase zero which is highlighted in grey and one in phase one which is highlighted in blue. Both are described within this thesis as they evidence the value of action research as a dynamic tool for innovation with a continual and changeable life cycle.
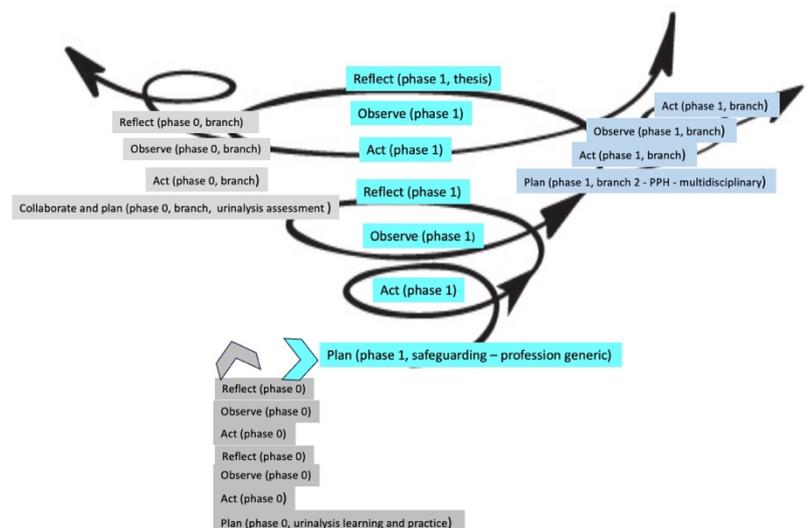
Elements of each action research phase displayed as text:

Plan (phase zero)
Idea for concept testing VRLE offering opportunities to practice skills for urinalysis is generated by midwifery students feedback that the gap between this session and being able to use these skills in clinical practice is too long and they fear they will deskill.

Act (phase zero)
Funding bids / funding sourced
Adapt lesson plan for urinalysis clinical skills session into a written scenario with a cast of characters.
Find SME developer
Translate this scenario into a storyboard for VRLE developer
Write ethics checklist / approval granted

Ask colleagues to trial VRLE and look for any obvious errors before students use it

Observe (zero)
Gather feedback from colleagues

Reflect (phase zero)
Consider findings and further action to be taken
- Minor typos and continuity errors and broken links

Act (phase zero)
Based on colleague's feedback, communicate with developers to make any minor changes
Recruit students willing to test protoype and provide both quantitative and qualitative feedback

Observe (phase zero)
Gather data
       One week for pre -intervention questionnaire
       Two weeks for use of urinalysis VRLE
       One week for post intervention questionnaire

Reflect (phase zero)
Consider data and generate findings
- Change phrasing of some quantitative questions to reduce risk of confirmation bias
-

Plan phase zero (branch) – consider moving this up to phase zero rather than here
Consider request from colleague to adapt urinalysis VRLE to be used for assessment during covid lockdown when L4 students not able to enter clinical practice

Act phase zero (branch)
Collaborate with colleague and work with developers to implement this

Observe phase zero (branch) Use of the urinalysis VRLE as a method of assessment

Reflect phase zero (branch)
This was done by the colleague who was the lead for the unit in which the urinalysis VRLE was used for assessment during the time when L4 students were not allowed in clinical practice because of the limitations of the covid-19 pandemic on staffing levels

PHASE ONE --------------- THIS DOCTORAL PROJECT ---------------PHASE ONE--------

Plan (phase one, this doctoral research project)
Lit review
Amend ethics checklist (August 2019)

Act (phase one)
Write safeguarding scenarios

Observe (phase one)
Send safeguarding scenario to specialist safeguarding clinical colleague for feedback
Gather feedback from multidisciplinary clinical colleagues on the suitability of the generic safeguarding VRLE for use by different healthcare disciplines

Act (phase one)
Make minor changes after the feedback from colleagues

Storyboard safeguarding scenario
- Include task choices which will indicate humanisation of care
- Build in gut instinct button
- Include soft skills

Collaborate with developers to build safeguarding VRLE

Observe (phase one, rolling enrolment)
Gather feedback from research participants (RP) for this research project
One month for pre -intervention questionnaire (Feb – May 2020)
One month for use of allocated safeguarding VRLE (March – July 2020)
One month for post intervention questionnaire (June – August 2020)
Focus groups conducted (September – November 2020)

Reflect (phase one)
Consider findings and further action to be taken
Write thesis

Plan (phase one, branch)
Request from senior colleague to develop a VRLE for emergency skills – specifically
Postpartum Haemorrhage (PPH) to sit within the Midwifery Emergencies (ME) unit

Act (phase one, branch)
Work with colleague who is the lead for the ME unit to write a scenario for PPH
Convert this to a storyboard for the developers to build as a generic profession PPH
VRLE

Observe (phase one, branch) Gather feedback from colleagues about the PPH VRLE

Reflect (phase one, branch)
Consider request that storyboard supports both synchronous and asynchronous use
Reflect on benefits of this vs cost

Act (phase one, branch)
Make amendments based on changes in guidance for PPH pharmaceuticals
Release PPH VRLE for use by students to support individual and group learning and
revision / assessment preparation

Elements of each action research phase displayed as a table

Action Research Elements	Phase zero - prior to this doctoral research	Phase zero branch	Phase one – this doctoral research	Phase one branch
Plan	Idea for concept testing VRLE offering opportunities to practice skills for urinalysis is generated by midwifery students feedback that the gap between this session and being able to use these skills in clinical practice is too long and they fear they will deskill.	Consider request from colleague to adapt urinalysis VRLE to be used for assessment during covid lockdown when L4 students not able to enter clinical practice	Lit review Amend ethics checklist	Request from senior colleague to develop a VRLE for emergency skills – specifically Postpartum Haemorrhage (PPH) to sit within the Midwifery Emergencies (ME) unit

Act	Funding bids / funding sourced Adapt lesson plan for urinalysis clinical skills session into a written scenario with a cast of characters. Find SME developer Translate this scenario into a storyboard for VRLE developer Write ethics checklist / approval granted Ask colleagues to trial VRLE and look for any obvious errors before students use it	Collaborate with colleague and work with developers to implement this	Include task choices which will indicate humanisation of care Build in gut instinct button Include soft skills Write safeguarding scenarios Storyboard safeguarding scenario Collaborate with developers to build safeguarding VRLE	Collaborate with colleague who is the lead for the ME unit to write a scenario for PPH Convert this to a storyboard for the developers to build as a generic profession PPH VRLE
Observe	Gather feedback from colleagues	Use of the urinalysis VRLE as a method of assessment	Send safeguarding scenario to specialist safeguarding clinical colleague for feedback Gather feedback from multidisciplinary clinical colleagues on the suitability of the generic safeguarding VRLE for use by different healthcare disciplines	Gather feedback from colleagues about the PPH VRLE
Reflect	Minor typos and continuity errors and broken links	This was done by the colleague who was the lead for the unit in which the urinalysis VRLE was used for assessment during the time when L4 students were not allowed in clinical practice because of the limitations of the covid-19 pandemic on staffing levels	Remove profession specific tasks Change inference in indicated dialogue	Consider request that storyboard supports both synchronous and asynchronous use Reflect on benefits of this vs cost
Act	Based on colleague's feedback, communicate with developers to make any minor changes Recruit students willing to test		Make minor changes aft the feedback from colleagues	Make amendments based on changes in guidance for PPH pharmaceuticals

	protoype and provide both quantitative and qualitative feedback			Release PPH VRLE for use by students to support individual and group learning and revision / assessment preparation
Observe	Gather data		Gather feedback from research participants (RP) for this research project	
Reflect	Consider data and generate findings Change phrasing of some quantitative questions to reduce risk of confirmation bias		Consider findings and further action to be taken	
Act			Write thesis	

Appendix 6: merged pre-action quantitative data (phase one – this research project)

VRLE pre-use (level 4 UK)

Showing 311 of 311 responses

Showing **all** responses

Showing **all** questions

Response rate: 44%

Responses merged with the following surveys:
- VRLE pre-use (level 5 UK)
- VRLE pre-use (level 6 UK)
- VRLE pre-use (East level 4 UK)
- VRLE pre-use (Physio students)
- VRLE pre-use (PH students)
- VRLE pre-use (level 5 paramedics UK)

1 I have read and understood the information provided. I consent to completing the questionnaire.

Yes	**311** (100%)

2 What technologies have you previously used in education?

Showing all 311 responses	
Virtual classroom Hazard perception(driving test)	507661-507652-51107240
Computer based learning Simulated learning in clinical skills labs	507659-507650-51150234
Brightspace BURP Mobile phone surveys	507659-507650-51178659
Learning apps such as Kahoot and quizlet	507659-507650-51178711
Learning apps including, kahoot, quizlet.	507659-507650-51178721
computer, ipad, mobile phone	507659-507650-51236908
Moodle Brightspace Office packages	507659-507650-51262603
Computer software i.e. Kahoot, Menti etc.	507659-507650-51316027

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Online quizzes, internet, Powerpoint and a VR hazard course for driving.	507659-507650-51321475
Virtual learning environment uploads, file sharing, projector powerpoints	507659-507650-51329810
Mobile Technology	507659-507650-51332567
none	507659-507650-51339722
iPads, phone, computer	507659-507650-51340533
PC, interactive whiteboard, minti quizzes	507659-507650-51340696
Apps, web search, websites, library online search	507659-507650-51341223
Nothing like VR- only an audio powerpoint	507659-507650-51342417
Phones & tablets	507659-507650-51342582
Online quiz Interactive websites	507659-507650-51343168
Computers.	507659-507650-51343276
Computers/Laptop	507659-507650-51343534
PowerPoint, computer, phone	507659-507650-51345783
Laptop Mobile Phone	507659-507650-51346133
Powerpoints Interactive quizes	507659-507650-51346716
Computers, Simulation Dolls, Tablets, Phones, Smart Boards	507659-507650-51348638
Computers IPAD Mobile Phone	507659-507650-51348664
Computers, Phones	507659-507650-51349207
ipads computers telephones	507659-507650-51350381
N/A	507659-507650-51350428
kahoot/quizlet	507659-507650-51351113
Computers, TVs, iPads	507659-507650-51355659
Computers, Iphone and Ipad	507659-507650-51355554
Laptops	507659-507650-51355801
Computer Mobile phone	507659-507650-51355730
Laptops, iPads, mobile phones, smart boards	507659-507650-51355737
Apps	507659-507650-51355850
iPad, phone, laptop	507659-507650-51355939

Computer, laptop, microscopes.	507659-507650-51355835
Laptop	507659-507650-51356051
Laptops/ PC	507659-507650-51355887
PC, tablet, laptop	507659-507650-51356157
computer	507659-507650-51356293
Computer	507659-507650-51356116
Websites and apps	507659-507650-51356380
Computers	507659-507650-51356115
Online sites	507659-507650-51356451
laptops, phones, computers.	507659-507650-51356336
Laptop	507659-507650-51356846
Laptop	507659-507650-51356342
Laptop Phone	507659-507650-51356832
limited	507659-507650-51356871
Microsoft Word, Powerpoint and Excel	507659-507650-51357061
Laptop, phone, IPad	507659-507650-51362225
laptop, computer, microscope	507659-507650-51372323
Computers	507659-507650-51373589
Computers, Laptops Mobile device.	527859-527850-51456170
LAPTOP	527859-527850-51473443
Ipads Computers	527859-527850-51478725
Computer, laptop, tablet, mobile phone.	527859-527850-51485113
e-learning programmes	527859-527850-51486535
e-learning programmes	527859-527850-51487463
Laptop Computer	527859-527850-51489866
Audio Powerpoint, BURP, Online Resources, Books.	527859-527850-51499709
Computers - word, excel, photoshop, illustrator	527859-527850-51501544
Online resources (powerpoints), apps e.g. quizlet	527859-527850-51523407
Computers, iPads, iPods, mobile phones, laptops, chromebooks, interactive whiteboards.	527859-527850-51526432
Laptops, Computers and mobile devices	527859-527850-51546360
Limited	527859-527850-51548995

Limited	527859-527850-51548905
laptops, online questionnaires, ipads, smart boards.	507661-507652-51550595
stimulation room, laptops, projectors, videos	527859-527850-51552192
Online Learning Resources	527859-527850-51555539
none	507659-507650-51557948
Pc, Phones	527859-527850-51561574
laptops, phone, projectors	527859-527850-51566566
Kahoot	527859-527850-51608136
Computer	527859-527850-51617122
Only standard computers/iPads	527859-527850-51619681
Computer, laptop, mobile	527859-527850-51619686
MOBILE, LAPTOP	527859-527850-51619723
IPad. Laptop	527859-527850-51619651
Laptop, iPod, Phone, iPad, Computer, Chromebook	527859-527850-51619748
Computers Mobile phone	527859-527850-51619858
Tablet and laptop	527859-527850-51619740
Computers, mobile, interactive whiteboards, tablets	527859-527850-51619637
Laptop	527859-527850-51619940
online softwares, Ipads, PC etc	527859-527850-51619647
Nothing other than websites such as bright space	527859-527850-51627944
Computer, microsoft applications, mobiles for quiz use.	507661-507652-51723195
None	507661-507652-51725680
Apps, internet, online platforms	507661-507652-51725615
computers/laptop interactive whiteboards	507661-507652-51757263
VRLE once	507661-507652-51771560
Interactive sessions	507661-507652-51797373
Internet quiz games	507661-507652-51928212
Laptop, ipad, computer and phone	507661-507652-51929015
the computer,phone	507661-507652-51929272
Computers, projectors, ipads	507661-507652-51931862
phone, computer and laptop	507661-507652-51933436

computer calculator	507661-507652-51938268
Computer	507661-507652-51945572
Laptops, tablets and mobile phones	507661-507652-51956489
LAPTOP	507661-507652-51957101
Powerpoints and videos	507661-507652-51957134
Technologies???? No online teaching	507661-507652-51958229
Computers/laptops Class blogs Video class Cohort forums	507661-507652-51958235
laptop Smart board	507661-507652-51967975
Laptops, Phones, Computers, virtual reality	507661-507652-51968056
None	507661-507652-51971855
Phone, computer, iPad, laptop	507661-507652-51954678
None	507661-507652-51975215
laptops phones intranets	507661-507652-51975245
Laptop Phone	507661-507652-51975253
Phones, laptops	507661-507652-51975211
Pc	507661-507652-51975327
iPad Laptops	507661-507652-51975304
PowerPoint, word internet	507661-507652-51975314
None	507661-507652-51975218
Computers.	507661-507652-51975407
Ipad, Laptop and variety of softwares	507661-507652-51975390
Computers, tablets, phone,	507661-507652-51975400
Smart boards Ipads Laptops	507661-507652-51975516
We trialled a virtual reality system once	507661-507652-52497645
I have used interactive websites, plain text websites and like to use technology to further my learning. Videos, quizzes etc.	507661-507652-52534548

iPad Computer	507661-507652-52535172
apps	507661-507652-52558793
Internet searches Videos online audio power point	507661-507652-52657592
Computer, Ipads	507661-507652-52679442
Very little	507661-507652-52695392
Laptop, Phone	507661-507652-52726401
A computer	507661-507652-52735826
Computers and tablets	507661-507652-52735934
Only ever computers/ tablets.	507661-507652-52736452
laptops and iPad	507661-507652-52739484
Laptop, mobile phone, headset simulation	507661-507652-52740136
Computers, iPads	507661-507652-52743386
Laptop, Computers, smartphones	507661-507652-52743681
laptops/ pcs Phones for classroom games etc like KAHOOT	507661-507652-52743954
Computers, laptops, iPads	507661-507652-52747726
iPad Laptop	507661-507652-52751837
Computer	507661-507652-52759910
Laptop tablet mobile	507661-507652-52765325
Kahoot	507661-507652-52781774
Phone tablet laptop	507661-507652-52781883
Ipads, projectors	565197-565188-55332579
Only basic forms such as powerpoints, videos and photos	565197-565188-55347590
Computer, phone	565197-565188-55382014
Mobile devices	565197-565188-55418786
Wearables, online interactives, social media	565197-565188-55419928
none	565197-565188-55422335
apps	565197-565188-55481110
Thereputic ultrasound, tens machine, compex, shockwave	565197-565188-55541337

Thereputic ultrasound, tens machine, compex, shockwave.	565197-565188-55541337
iPads, smart boards	565197-565188-55559287
Computers	565197-565188-55572272
Computers, rehab equipment, sports science equipment, medical equipment	565197-565188-55572504
Isokinomatic machine, ultrasound, tens machine.	565197-565188-55573740
None	565197-565188-55594931
None	565402-565393-55624813
PowerPoint, word , excel, skype	565402-565393-55625318
not able to answer	565402-565393-55635629
none	565402-565393-55636632
Online seminars and virtural learning	565402-565393-55647433
Laptops presentations etc	565402-565393-55659978
Simulation	565402-565393-55659977
simulation,	565402-565393-55660054
Online learning portals/packages such as e-learning	565402-565393-55659998
microsoft office programmes,	565402-565393-55660061
Apps, online learning environment, E-learning packages	565402-565393-55659979
Basic word PowerPoint and excel	565402-565393-55660070
Powerpoint	565402-565393-55659992
Just on line presentations. Not audio	565402-565393-55660559
Microsoft Office Programmes	565402-565393-55660048
chrome book and laptop	565402-565393-55660740
Computer	565402-565393-55662488
Other than computers, nothing.	527859-527850-56655091
VLE - virtual learning environment during senior scool	581929-581920-57300053
PC	581929-581920-57302664
Computers, laptops	581929-581920-57324319
computers, over head projectors.	581929-581920-57324445
padlet	581929-581920-57338176
Internet, classroom, audio	581929-581920-57348138
power point etc...	581929-581920-57348068
laptop, phone, apps	581929-581920-57348340

none	581929-581920-57348758
mentimeter	581929-581920-57357260
Too many!!	581929-581920-57360184
Laptop, Tablet, Phone	507662-507653-57654268
Virtual learning	507662-507653-57654437
virtual clinic	507662-507653-57678533
computers, laptops, ipad, kahoot	507662-507653-57678805
Computers and mobile devices	507662-507653-57678945
microsoft, hospital intranet, brightspace, email	507662-507653-57679299
laptop mindview software zotero software ebooks e-learning for health BURP and Maco learning packages	507662-507653-57678794
Computer, phone, laptop	507662-507653-57681309
virtual learning	507662-507653-57682014
Virtual learning	507662-507653-57682025
Brightspace PowerPoint Word	507662-507653-57682086
virtual reality in 1st year for MSU computers	507662-507653-57682834
computers, online questionnaires, powerpoint	507662-507653-57684693
NA	507662-507653-57686090
I have used fieldscapes in the first year	507662-507653-57688530
Online web portals, padlet, VR	507662-507653-57691915
Computers, iphones	507662-507653-57695002
online, virtual	507662-507653-57696259
online packages	507662-507653-57696255
Laptops, Ipads.	507662-507653-57696269
powerpoint	507662-507653-57696256
Computers/laptops Quiz apps	507662-507653-57696291
padlet kahoot google docs	507662-507653-57696266
Smart Screens	507662-507653-57696472

Smart Screens	507662-507653-57696472
nil	507662-507653-57696262
limitted	507662-507653-57696258
None	507662-507653-57696265
none	507662-507653-57696410
Laptop Tablets	507662-507653-57696288
Brightspace VLE Online lessons	507662-507653-57696260
powerpoints, internet, apps	507662-507653-57696273
Ipad, laptop	507662-507653-57705762
Online classes Apps	507662-507653-57705767
VRLE	507662-507653-57705753
VRLE Voom ipads	507661-507652-58931238
Phones, computers, laptops, iPads/tablets, iPods, interactive whiteboards	507661-507652-58940661
Interactive whiteboards, VRLE, iPads	507661-507652-58962935
VRLE at Level 4 Powerpoints Virtual Classroom	507661-507652-58990603
Computer, Phone	507661-507652-58991523
None, other than computers for general learning.	507661-507652-59047485
Laptop, phone	507661-507652-59055463
Fieldscape VRLE (L4) Kahoot Zoom Online Classroom	507661-507652-59063035
None	507661-507652-59064530
I haven't really used any other technologies in education other than the basics of computer learning and presenting.	507661-507652-59064860
Computer based programs, virtual learning, interactive whiteboards, ebooks, mobile - quiz, questionnaires.	507661-507652-59078412
computers padlet virtual classroom	507661-507652-59087409
kahoot	507661-507652-59096292
LAPTOP, PHONE	507661-507652-59096678

LAPTOP, PHONE	507661-507652-59096678
Fieldscapes VRLE with BU. Other than that only basic tech such as Microsoft office.	507661-507652-59096674
Fieldscapes in level 4	507661-507652-59096691
Computer, App, Phone.	507661-507652-59096677
Live chat, Virtual reality	507661-507652-59096408
Computer, apps	507661-507652-59096684
Only what has been used a Bournemouth University	507661-507652-59096718
Basic computer softwares, virtual classrooms	507661-507652-59096688
Webcam chat, VRLE, smart board, PowerPoint	507661-507652-59096710
VRLE Very little, I'm not a tech person	507661-507652-59096679
Computers	507661-507652-59096721
Computers, ipads	507661-507652-59096724
I used fieldscapes in level 4	507661-507652-59100957
very little	507661-507652-59176284
VRLE in a previous safeguarding session	507661-507652-59321561
computers, tablets, phones	507661-507652-59326946
VRLE (L4) Presentations Videos Virtual classroom	507661-507652-59388788
Computer, fieldscapes, zoom, messenger, virtual classroom	507661-507652-59413294
Zoom, BONGO	507661-507652-59422159
Usual computer software and web based programmes	507661-507652-59428537
VRLE	507661-507652-59429074
I have not used any in comparison with VRLE, it has just been the basic microsoft office, word, excel, powerpoint etc.	507661-507652-59429688
Zoom. Virual Classroom. Powerpoints with and without audio	507661-507652-59429792
field-scapes	507661-507652-59444001
VRLE in level 4	507661-507652-59447153
online file sharing - brightspace VR	507661-507652-59452337
comps/laptops mobile phones Microsoft email	507661-507652-59455513
Powerpoint	507661-507652-59455703

Powerpoint VR Padlet Google docs	507661-507652-59455705
IPHONE	507661-507652-59465197
Computers, Interactive whiteboards, phones	507661-507652-59465179
Ipads, laptops, mobile phones	507661-507652-59465186
fieldscape	507661-507652-59465171
some use of VLRE	507661-507652-59465187
Microsoft. Fieldscapes. Zoom	507661-507652-59465174
powerpoint, genially, photoshop, excel, world, padlet...	507661-507652-59465189
Laptop, iPad,	507661-507652-59465196
Laptop, pc, tablet	507661-507652-59465184
Laptops, I pad	507661-507652-59465190
i have not	507661-507652-59465180
Powerpoints, Internet	507661-507652-59465172
Fieldscapes	507661-507652-59465168
VRLE AT LEVEL 4	507661-507652-59465227
Skype, Zoom, VRLE	507661-507652-59465241
Computers	507661-507652-59465188
Interactive, computer presentations	507661-507652-59465167
interactive computer sessions	507661-507652-59465173
fieldscapes, zoom, virtual classroom, kaboodle, brightspace	507661-507652-59465176
Office systems	507661-507652-59465185
apps, online reading and microsoft accounts	507661-507652-59465191
Laptop Phone	507661-507652-59465183
Computers, tablets, phones	507661-507652-59465225
Laptops PowerPoints	507661-507652-59465434
MacBook Phone Ipad	507661-507652-59465182
none	507661-507652-59465377
just a computer	507661-507652-59465169
None	507661-507652-59465518

Computers and previously used the VRLE	507661-507652-59465177
Powerpoints, audio powerpoints, zoom, virtual classroom.	507661-507652-59465199
Mostly powerpoints and limited technologies. Did use the VRLE for level 4 safeguarding	507661-507652-59465195
A shared platform at college similar to brightspace that we were able to share documents and access school work.	507661-507652-59465178
Panopto Zoom	565197-565188-59548235
tablets laptops interactive whiteboards electrical stimulation	565197-565188-59597468
PC, laptop, tablet, mobile phone, watch,	565197-565188-59658302
Apps VR PC	565197-565188-59666900
Virtual reality PC Smartphone Laptop Tablet Internet Skype Zoom	565197-565188-59670780
Computer Ipad	565197-565188-59672036
Internet on PC Apps to help with knowledge based learning	565197-565188-59672306
Virtual reality goggles to demonstrate what it is like to have dementia.	565197-565188-59672845
Computer Apps	565197-565188-59675612
Iphone and laptop	565197-565188-59677913
Ipads	565197-565188-59670314
Laptops, office, projectors, emails,	565197-565188-59680356
PC VR headsets	565197-565188-59680351
vr Internet online learning systems	565197-565188-59680469
Laptop/Mac	565197-565188-59681896
Power point, videos, VR head sets, interactive quizzes	565197-565188-59686402
computer technologie	565197-565188-59688339

computer technologie specialist assistive technologie for my studies	565197-565188-59688399
Apps, blogs, vlogs	565197-565188-59688805
i used virtual realtity during first and second year of university	565197-565188-59682834
Only this for urinalysis and safeguarding	507662-507653-62595230

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3 What is your previous experience with virtual reality technology?

Showing all 311 responses	
I found it useful, and meant that the lecture was still able to deliver the lesson because of unforeseeable reasons. It allowed all who participated in the lesson to interact with each other.	507661-507652-51107240
Used for fun as a game	507659-507650-51150234
No experience	507659-507650-51178659
I found using online tools such as kahoot and quizlet really helpful as it gets you thinking on your feet and makes you want to get the answers right as your playing with others.	507659-507650-51178711
Used Kahoot which was useful as it showed me whether what I had just learnt in lesson actually sunk in. As such, I knew how much more revision I have to do after the lecture.	507659-507650-51178721
very little	507659-507650-51236908
None	507659-507650-51262603
Do not have any	507659-507650-51316027
I have access to a headset VR for games and that's it.	507659-507650-51321475
I havent used it	507659-507650-51329810
I have none	507659-507650-51332567
none	507659-507650-51339722
I've never used it before	507659-507650-51340533
None	507659-507650-51340696
I have never used virtual reality with a headset	507659-507650-51341223
NONE	507659-507650-51342417
I have only ever played virtual relaity games at home never for educational purposes	507659-507650-51342582
Never previously used Virtual Reality technology	507659-507650-51343168
I do not have much experience as I have only used it once before on a science trip about dementia.	507659-507650-51343276
None	507659-507650-51343534

None	507659-507650-51345783
I have only used it once and I did find i got a little motion sickness.	507659-507650-51346133
N/A	507659-507650-51346716
Never Used Before	507659-507650-51348638
Never used before	507659-507650-51348664
Played games on a cheap Samsung headset that is used with phone apps.	507659-507650-51349207
Not much	507659-507650-51350381
N/A	507659-507650-51350428
none	507659-507650-51351113
No experience	507659-507650-51355659
I have done VR to aid in dementia care when i done my placement in a care home	507659-507650-51355554
I used to sell it and have used many different VR's	507659-507650-51355801
I don't have any	507659-507650-51355730
I have used it recreationally	507659-507650-51355737
Nothing	507659-507650-51355850
None	507659-507650-51355939
Never used it before.	507659-507650-51355835
I haven't	507659-507650-51356051
None	507659-507650-51355887
None	507659-507650-51356157
none	507659-507650-51356293
None	507659-507650-51356116
N/A	507659-507650-51356380
N/A	507659-507650-51356115
None	507659-507650-51356451
none	507659-507650-51356336
none	507659-507650-51356846
Have not had any previous experience	507659-507650-51356342
None	507659-507650-51356832
none	507659-507650-51356871
None	507659-507650-51357061
No experience	507659-507650-51362225
none	507659-507650-51372323

none	507659-507650-51372323
None	507659-507650-51373589
None.	527859-527850-51456170
NONE	527859-527850-51473443
N/A	527859-527850-51478725
No prior experience.	527859-527850-51485113
very little experience	527859-527850-51486535
very little experience	527859-527850-51487463
None	527859-527850-51489866
Used it do prepare for sessions, develop my understanding of topics, watch videos and its been really helpful and useful.	527859-527850-51499709
I have used a virtual reality headset before recreationally	527859-527850-51501544
I have mainly used in for entertainment (playing games)	527859-527850-51523407
I have used a VR headset before but not for learning.	527859-527850-51526432
none	527859-527850-51546360
Hardly used	527859-527850-51548905
good.	507661-507652-51550595
used laptops and projectors	527859-527850-51552192
I haven't used it before.	527859-527850-51555539
none	507659-507650-51557948
N/A	527859-527850-51561574
none	527859-527850-51566566
Enjoyable, interactive and a fun way of learning.	527859-527850-51608136
None	527859-527850-51617122
I haven't used it	527859-527850-51619681
Not much experience	527859-527850-51619686
Vaguely used in the past	527859-527850-51619723
None	527859-527850-51619651
I have only used the goggles.	527859-527850-51619748
None	527859-527850-51619858
None	527859-527850-51619740
No experience	527859-527850-51619637
None	527859-527850-51619940
no educational experience, although apps on the App Store for fun	527859-527850-51619647

Only games as a child such as sims	527859-527850-51627944
nil.	507661-507652-51723195
Never used it before	507661-507652-51725680
Only when trialling VR for urinalysis	507661-507652-51725615
bought a headset that you can put your phone in and play games/watch 3D videos	507661-507652-51757263
Very helpful	507661-507652-51771560
None	507661-507652-51797373
none	507661-507652-51928212
none	507661-507652-51929015
none	507661-507652-51929272
None	507661-507652-51931862
I have no experience	507661-507652-51933436
none	507661-507652-51938268
None	507661-507652-51945572
I don't really get on with it, I find it confusing and sometimes fast paced for my personal learning	507661-507652-51956489
nil	507661-507652-51957101
None	507661-507652-51957134
none	507661-507652-51958229
None, possibly in primary education but not since.	507661-507652-51958235
none	507661-507652-51967975
Used it in school in science	507661-507652-51968056
None	507661-507652-51971855
..	507661-507652-51954678
None	507661-507652-51975215
Have not had much experience	507661-507652-51975245
None	507661-507652-51975253
None	507661-507652-51975211
Complicated	507661-507652-51975327
Minimal	507661-507652-51975304
None	507661-507652-51975314
Limited experience, previously part of a study to learn urinalysis on a VLE	507661-507652-51975218

Good. Makes learning more fun.	507661-507652-51975407
I have played computer games in the past but for a learning experience, this will be the first time.	507661-507652-51975390
Used it on social occasions	507661-507652-51975400
none	507661-507652-51975516
minimal	507661-507652-52497645
I have only use virtual reality for fun, with games consoles or smartphones.	507661-507652-52534548
Nil	507661-507652-52535172
no experience	507661-507652-52558793
Very little	507661-507652-52657592
I have no experience with virtual reality technology.	507661-507652-52679442
previous fieldscapes urinalysis VR	507661-507652-52695392
I haven't used it	507661-507652-52726401
I don't have any.	507661-507652-52735826
Not very experienced but intrigued by it	507661-507652-52735934
I have never used it.	507661-507652-52736452
i do not have enough experience with the virtual reality technology	507661-507652-52739484
Used it during a dementia theme day to give an idea of what living with dementia is like. Really useful way of learning.	507661-507652-52740136
Have seen it in use but never used	507661-507652-52743386
I haven't experienced it yet	507661-507652-52743681
none	507661-507652-52743954
Useful	507661-507652-52747726
None	507661-507652-52751837
None	507661-507652-52759910
none	507661-507652-52765325
Interesting but never used it in an educational setting	507661-507652-52781774
none	507661-507652-52781883
None	565197-565188-55332579
I have had no previous experience	565197-565188-55347590
None	565197-565188-55382014
None	565197-565188-55418786
Never used it before	565197-565188-55419928
none	565197-565188-55422335

none	565197-565188-55481110
Only in a pleasure scenario e.g. at a festival stand	565197-565188-55541337
None	565197-565188-55559287
N/a	565197-565188-55572272
None	565197-565188-55572504
None.	565197-565188-55573740
None	565197-565188-55594931
None	565402-565393-55624813
None	565402-565393-55625318
very little	565402-565393-55635629
N/A	565402-565393-55636632
n/a	565402-565393-55647433
I have used them for entertainment purposes only	565402-565393-55659978
None	565402-565393-55659977
none	565402-565393-55660054
None!	565402-565393-55659998
none	565402-565393-55660061
I have no previous experience	565402-565393-55659979
None	565402-565393-55660070
None	565402-565393-55659992
None	565402-565393-55660559
None	565402-565393-55660048
I have never used it.	565402-565393-55660740
None	565402-565393-55662488
None	527859-527850-56655091
none	581929-581920-57300053
minimum	581929-581920-57302664
I did a virtual dementia experience before coming to university which demonstrated what it would be like to live with dementia. It used headsets and goggles to enhance sound and distort vision.	581929-581920-57324319
nill	581929-581920-57324445
none	581929-581920-57338176
None	581929-581920-57348138
tried it a few times	581929-581920-57348068

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not much!	581929-581920-57348340
this week is good	581929-581920-57348758
it was good, makes it more interactive	581929-581920-57357260
None	581929-581920-57360184
Online chat tools	507662-507653-57654268
limited	507662-507653-57654437
only what denyse has given us accees to	507662-507653-57678533
we used it once in first year	507662-507653-57678805
Not used before	507662-507653-57678945
I have used it once when in first year	507662-507653-57679299
none	507662-507653-57678794
None	507662-507653-57681309
used at uni in first year	507662-507653-57682014
Was good and interesting	507662-507653-57682025
Not much	507662-507653-57682086
Previously owned an occulus rift and used this for some of my anatomy and physiology revision via some of the human anatomy apps/games.	507662-507653-57682834
nil	507662-507653-57684693
NA	507662-507653-57686090
very limited	507662-507653-57688530
very minimal, I had one session with it	507662-507653-57691915
Urinalysis in 1st year	507662-507653-57695002
None	507662-507653-57696259
None	507662-507653-57696255
On personal games.	507662-507653-57696269
limited	507662-507653-57696256
None, only within this degree have I experienced VRLE	507662-507653-57696291
none	507662-507653-57696266
None	507662-507653-57696472
very limited	507662-507653-57696262
in year 1, urinalysis	507662-507653-57696258
VRLE used before in 1st year	507662-507653-57696265
none	507662-507653-57696410

Prior to this I have not had much experience with virtual reality technology. I found this useful and it allows you to understand ways to approach situations with open questions.	507662-507653-57696288
In 1st year we used VRLE	507662-507653-57696260
limited experience	507662-507653-57696273
nil	507662-507653-57705762
In 1st year	507662-507653-57705767
i find it slows down my computer but it helped with my learning	507662-507653-57705753
used once in education before, was ok not explained well.	507661-507652-58931238
I have used the virtual reality technology in my first year for safeguarding however I had used it before this.	507661-507652-58940661
It's more engaging and typically straightforward to understand	507661-507652-58962935
Only using the VRLE at Level 4	507661-507652-58990603
Have had one experience with it for my first safeguarding session used it on my computer	507661-507652-58991523
Using the VRLE for level 4 Melser family.	507661-507652-59047485
Only been using fieldscapes	507661-507652-59055463
Enjoyable.	507661-507652-59063035
Good	507661-507652-59064530
Having used the VRLE previously, I found it easy to use and it was an interesting learning experience.	507661-507652-59064860
Level 4 experience in VRLE.	507661-507652-59078412
I have used it once	507661-507652-59087409
L4 VRLE	507661-507652-59096292
minimal	507661-507652-59096678
N/A	507661-507652-59096674
Using fieldscapes in level 4	507661-507652-59096691
Not a lot but interesting using a different way to learn.	507661-507652-59096677
VRLE for first year	507661-507652-59096408
Only as part of the midwifery unit	507661-507652-59096684
as above	507661-507652-59096718
Have not not used it much but have heard that it's great for learning	507661-507652-59096688
I have used it before and I liked it	507661-507652-59096710
Level 4 safeguarding	507661-507652-59096679
Only have used virtual reality at university	507661-507652-59096721

Previous safeguarding training using virtual reality at the end of 2019.	507661-507652-59096724
Using fieldscapes in level 4	507661-507652-59100957
used in a unit last year	507661-507652-59176284
Once I was able to access it I found it a really good experience. It took a lot of time to load it and work which was the only negative side. It was an interesting and different way to learn and gave you an insight into a person's home so you could see pictorally what abuse can look like.	507661-507652-59321561
i seem to have technical difficulties	507661-507652-59326946
Good experience, however found it hard to navigate and use at first.	507661-507652-59388788
basic, but i can seem to use this	507661-507652-59413294
Small amount, 1 session	507661-507652-59422159
None	507661-507652-59428537
Some	507661-507652-59429074
Inadequate, the app kept crashing and I did not get to use it correctly.	507661-507652-59429688
In level 4 we briefly used this programme. I found that this system did not work and it didn't benefit my learning.	507661-507652-59429792
wasn't completely clear how to use it and used a lot of data and made device too hot to use and drained battery, as a result	507661-507652-59444001
It was used in level 4, lots of technical difficulties but once these had been overcome it was a good learning resource	507661-507652-59447153
only in 1st year midwifery safeguarding	507661-507652-59452337
during isolation it is increased. Have used VRLE briefly in other safeguarding sessions (L4) Zoom/facetime/skype	507661-507652-59455513
Used a little bit in one previous model	507661-507652-59455703
NONE	507661-507652-59465197
None apart from when we did it in first year.	507661-507652-59465179
Never used it before	507661-507652-59465186
uses once before in a lesson	507661-507652-59465171
limited	507661-507652-59465187
Only what what we completed in 1st year	507661-507652-59465174
for the H&W1	507661-507652-59465189
Just VRLE practice in L4.	507661-507652-59465196
none	507661-507652-59465184
depends what i went through	507661-507652-59465190
none	507661-507652-59465180

I used to sell it so have a lot of experience	507661-507652-59465172
An interesting take on education	507661-507652-59465168
ONLY LEVEL 4	507661-507652-59465227
One Uni session	507661-507652-59465241
For fun	507661-507652-59465188
Minimal	507661-507652-59465167
level 4 safeguarding	507661-507652-59465173
only once before within of our very early sessions about abuse.	507661-507652-59465176
Only in level 4 safeguarding	507661-507652-59465185
Can be useful but also widely open to error depending on how you access it; laptop/smart device and what internet you have available to you	507661-507652-59465191
I have only previously used in session this year. I found it very useful.	507661-507652-59465183
quite effective	507661-507652-59465225
Used once	507661-507652-59465434
We completed a virtual reality session last year which was my first time	507661-507652-59465182
no experience	507661-507652-59465377
very little	507661-507652-59465169
None	507661-507652-59465518
Used Breifly	507661-507652-59465177
Safeguarding Level 4	507661-507652-59465199
We used the VRLE for level 4 safeguarding, but no other experience other than that.	507661-507652-59465195
Only ever used at level 4 at Bournemouth University.	507661-507652-59465178
Dementia study day - used VR headset	565197-565188-59548235
none.	565197-565188-59597468
None	565197-565188-59658302
Minimal - gaming	565197-565188-59666900
Tried it once at university during training. Tried it from a gaming point of view at a convention.	565197-565188-59670780
None	565197-565188-59672036
None	565197-565188-59672306
Limited to use of VR goggles one time as a part of dementia awareness.	565197-565188-59672845
None	565197-565188-59675612
None	565197-565188-59677913

None	565197-565188-59670314
Entertainment	565197-565188-59680356
Used for gaming previously	565197-565188-59680351
very limited just used it once	565197-565188-59680469
None	565197-565188-59681896
VR head set to complete dementia training	565197-565188-59686402
One session i did in uni	565197-565188-59688339
None	565197-565188-59688805
minor	565197-565188-59682834
good - when it works	507662-507653-62595230

4 Do you think that Virtual Reality Learning Environments (VRLE) can help you to learn something new?

Yes **286** (92%)
No **9** (2.9%)
Other **18** (5.8%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
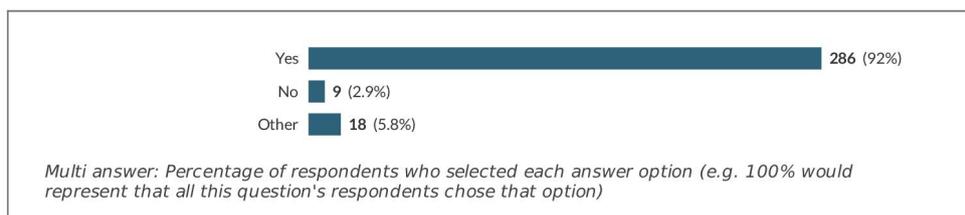
4.a If you selected Other, please specify:

Showing all 21 responses	
Not sure, I have no knowledge of it	507659-507650-51262603
Rather than learning stuff from VRLE, I think it will be useful to practice and reinforce things learnt in theory	507659-507650-51340533
I have no idea as I have no previous experience of VR.	507659-507650-51340696
Unsure as have no prior knowledge of VRLE	507659-507650-51345783
I am not sure yet	507659-507650-51356451
have the chance to see and use real life scenarios without the risks of being in the real life situation.	507659-507650-51356336
N/A	527859-527850-51499709
I do think that it is a good way to learn however sometimes it can be easy to move on from it quickly and not completely develop your knowledge and understanding of each topic to completely gain correct knowledge.	527859-527850-51608136
Hopefully - I've never used it before	507661-507652-51929015
Im skeptical	507661-507652-51975390
Yes in certain learning environments and circumstances	507661-507652-52657592
I'm unsure as I've had no experience with VRLE	507661-507652-52735826
Have no idea yet, hopefully so.	507661-507652-52751837
Don't really know	581929-581920-57348068
If they're relevant and done well.	581929-581920-57360184
not sure as have never used it before.	507662-507653-57678794
maybe	507662-507653-57682014
Yes but not if they ruin hardware	507661-507652-59465172
Not sure, need to give it another go. Was too busy in level 4	507661-507652-59465185
Because its something new.	565197-565188-59670780
It depends on the learning environment and the target audience	565197-565188-59682834

5 How do you rate your current level of confidence in clinical skills for safeguarding before using the Virtual Reality Learning Environments (VRLE)? Please rate from 1-10 with 1 being 'no confidence' in your clinical skills

1	**9** (2.9%)
2	**7** (2.3%)
3	**14** (4.5%)
4	**19** (6.1%)
5	**65** (20.9%)
6	**52** (16.7%)
7	**91** (29.3%)
8	**51** (16.4%)
9	**6** (1.9%)
10	**5** (1.6%)
Other	**4** (1.3%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
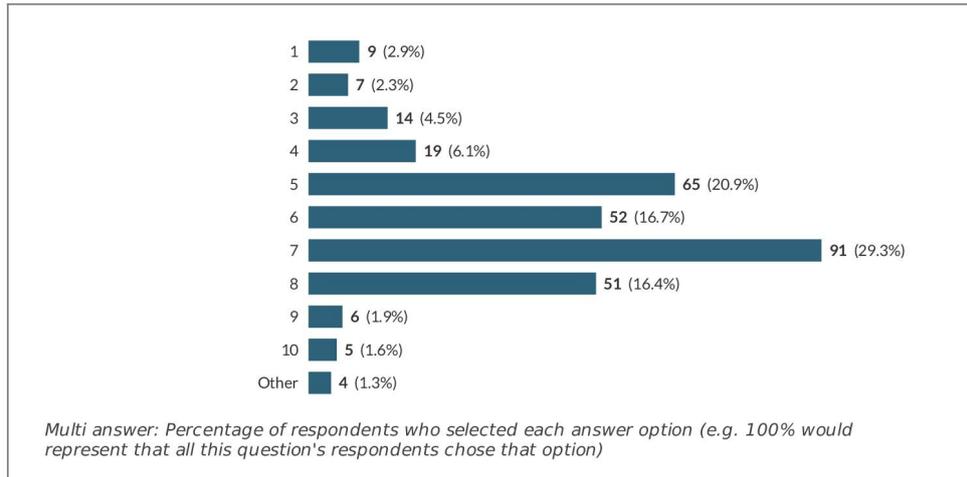
5.a If you selected Other, please specify:

Showing all 5 responses	
Feel confident using it but haven't used any for clinical skills yet.	507659-507650-51178721
Never used	565197-565188-55418786
don't have experience with virtual reality technology	565197-565188-55422335
I don't understand the question??	581929-581920-57300053
unfamiliar	565197-565188-59688805

6 Please rate your belief that Virtual Reality Learning Environments (VRLE) can help improve confidence in clinical practice. Please rate from 1-10 with 1 being no belief

1	**2** (0.6%)
2	**0**
3	**5** (1.6%)
4	**10** (3.2%)
5	**50** (16.1%)
6	**34** (10.9%)
7	**58** (18.6%)
8	**89** (28.6%)
9	**40** (12.9%)
10	**24** (7.7%)
Other	**3** (1%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
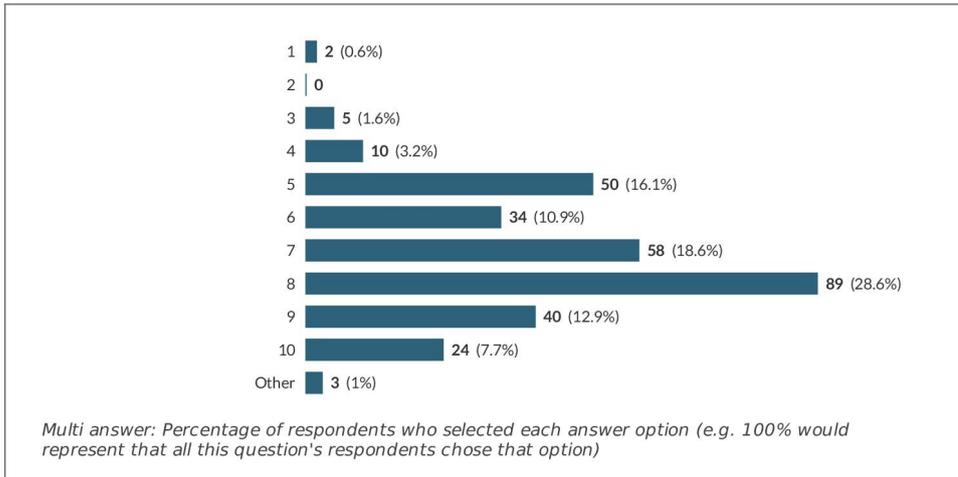
6.a If you selected Other, please specify:

Showing all 5 responses	
Unsure Yet Until I Have Tried, But Would Expect It Will	507659-507650-51348638
This will help alongside other resources.	527859-527850-51499709
Difficult to comment as not used VRLE	527859-527850-51619651
If it is a scenario that the student has very little experience of in practice, it could be helpful prior to gaining more practice experience.	565402-565393-55660740
unsure as haven't experienced it yet	507662-507653-57678794

7 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) can help bridge the gap between theory / practice. Please rate from 1-10 with 1 being no belief

1 **2** (0.6%)
2 **4** (1.3%)
3 **1** (0.3%)
4 **10** (3.2%)
5 **47** (15.1%)
6 **34** (10.9%)
7 **61** (19.6%)
8 **85** (27.3%)
9 **37** (11.9%)
10 **35** (11.3%)
Other **2** (0.6%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
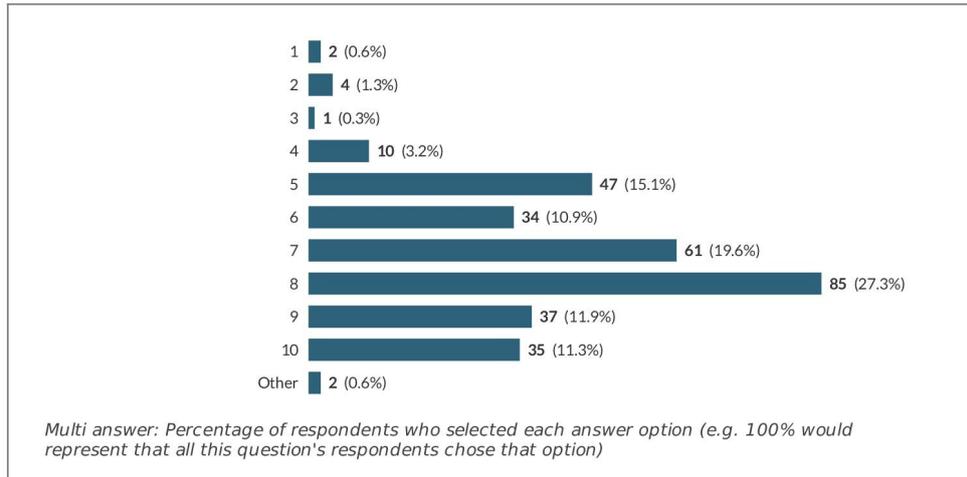
7.a   If you selected Other, please specify:

Showing all 2 responses	
unsure as haven't experienced it yet and do not know what it is.	507662-507653-57678794
In theory this could significantly benefit students if a good system is used	507661-507652-59429792

8   Please rate your belief that use of Virtual Reality Learning Environments (VRLE) for practising clinical skills will help you with learning to use intuitive practice (using your gut instinct). Please rate from 1-10 with 1 being no belief

1 **2** (0.6%)
2 **3** (1%)
3 **10** (3.2%)
4 **13** (4.2%)
5 **46** (14.8%)
6 **41** (13.2%)
7 **73** (23.5%)
8 **77** (24.8%)
9 **26** (8.4%)
10 **25** (8%)
Other **2** (0.6%)
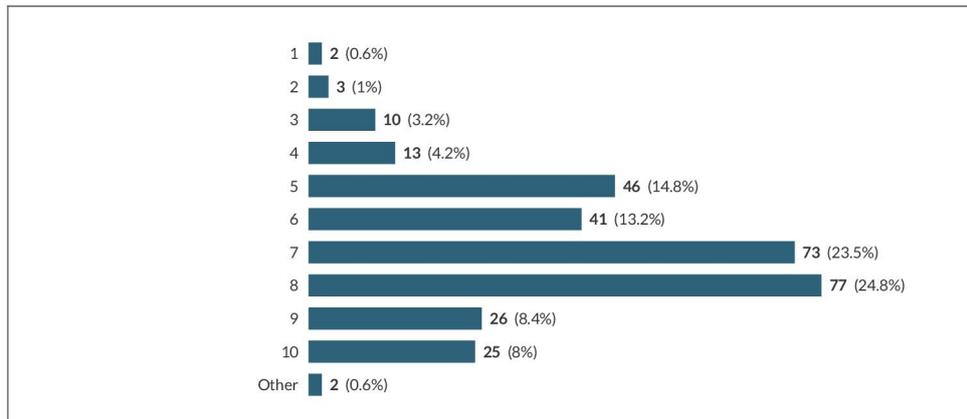
Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

8.a   If you selected Other, please specify:

Showing all 2 responses	
unsure as haven't experienced it yet and do not know what it is.	507662-507653-57678794
It depends on the siutation of the environment.	565197-565188-59682834

9   Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an impact on humanisation (the 6Cs: Care, Compassion, Competence, Communication, Courage, Commitment) of your healthcare skills.

Positive impact **236** (75.9%)
No impact **64** (20.6%)
Negative impact **5** (1.6%)
Other **14** (4.5%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

9.a   If you selected Other, please specify:

Showing all 15 responses	
Not sure as yet	507659-507650-51262603
Will wait and see	507659-507650-51345783
Unsure	527859-527850-51627944
Unsure	507661-507652-51725615
I have no idea	565402-565393-55635629
It appears fairly stilted and artificial. Misses a lot of the more subtle nuances such as body language, tone of voice found with real people. Actually being with real people in real situations develops care, compassion and communication.	565402-565393-55660740
no idea	581929-581920-57348068
Unsure	507662-507653-57678945
unsure as haven't experienced it yet and do not know what it is.	507662-507653-57678794
I would say its difficult to humanise care in a virtual environment so i'm not sure if this will have a positive or negative impact.	507662-507653-57682834
I am unsure how well it would impact this	507662-507653-57696410
Unsure	507661-507652-59096679
Not sure really other than through the discussion with others. I feel much of the 'humanisation' can only really come with practice, not all theory or virtual	507661-507652-59413294
Not sure. Not a negative comment, I just prefer to learn in a real classroom or in practice. I don't engage as well with IT. Feels impersonal	507661-507652-59465185
im unsure what the impact will be	507661-507652-59465169

10 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an impact with your learning?

Positive impact **285** (91.6%)
No impact **20** (6.4%)
Negative impact **2** (0.6%)
Other **7** (2.3%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
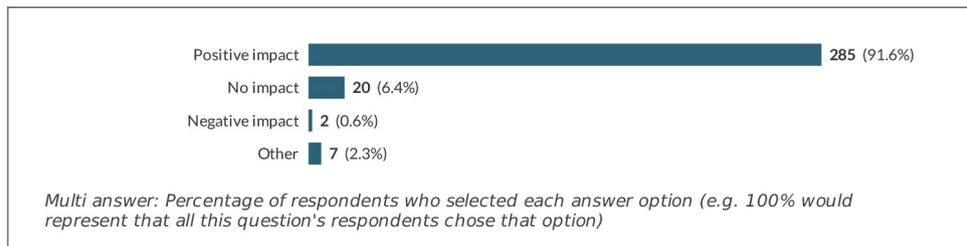
10.a If you selected Other, please specify:

Showing all 7 responses	
Again not sure	507659-507650-51262603
Limited impact, I prefer to learn within real situations with real people.	565402-565393-55660740
dont know	581929-581920-57348068
unsure as haven't experienced it yet and do not know what it is.	507662-507653-57678794
As above	507661-507652-59465185
not experienced it so unsure if it will help me.	507661-507652-59465169
some positive but gaining access to virtual reality can be time consuming and having access to download the softwear is not always available	565197-565188-59682834

11 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an associated impact on patient safety?

Positive impact	**268** (86.2%)
No impact	**36** (11.6%)
Negative impact	**0**
Other	**11** (3.5%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

11.a If you selected Other, please specify:

350
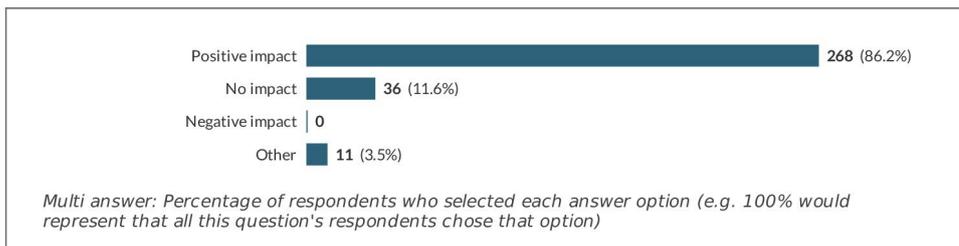
Showing all 11 responses	
No knowledge of software, unable to give opinions	507659-507650-51262603
This is because each situation is different and can result in a different consequence so it's important to take this into consideration to ensure patient safety.	527859-527850-51526432
Unsure	507661-507652-51725615
Unsure of the confidentiality and whats it like to use VRLE	565197-565188-55418786
I do not know	565402-565393-55635629
dont know	581929-581920-57348068
Unsure	507662-507653-57678945
unsure as haven't experienced it yet and do not know what it is.	507662-507653-57678794
Not sure yet. Don't feel like I've had enough experience with it	507661-507652-59465185
unsure	507661-507652-59465169
Again some impact but this depends on the patient comorbidities.	565197-565188-59682834

12 How many times do you expect to use the VRLE?

1 - 3 times	**173** (55.6%)
4 - 5 times	**103** (33.1%)
6 or more times	**35** (11.3%)
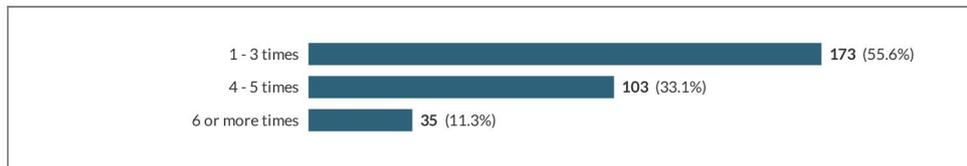
13 Would you like to tell the researcher anything else?

Showing all 47 responses	
I have no experience with this, but am optimistic that it will help my learning	507659-507650-51341223
not at present	507659-507650-51343534
None	507659-507650-51348638
N/A	507659-507650-51348664
N/A	507659-507650-51350428
no	507659-507650-51351113
No	507659-507650-51355801
N/A	507659-507650-51362225

no	527859-527850-51456170
no	527859-527850-51546360
I'm excited to try it out as it is a new way of learning for me	527859-527850-51566566
It is a different and enjoyable way to learn.	527859-527850-51608136
No	527859-527850-51619940
No.	507661-507652-51723195
n/a	507661-507652-51933436
All answers are dependent on the quality of the VRLE and how closely it portrays real life situations.	507661-507652-51938268
I dont think VRLE should take over lectures and lessons to support our knowledge and especially skills, I feel the VRLE will support confidence with technology and keeping uptodate but if not used carefully can really spoil some learning opportunities.	507661-507652-51956489
no	507661-507652-51954678
I believe that VRLE will be really good practise, and I believe that with enough scenarios based on real life, it will help and have a positive impact on confidence.	507661-507652-52534548
I think it is a good way of demonstrating what its like to be in somebody elses shoes.	507661-507652-52740136
the headset causes nausea, but really engaging and a really interactive way to almost put knowledge in to practice	507661-507652-52781883
I have no educational experience in this field so I found it difficult to answer with a strong judgement of VRLE	565197-565188-55541337
The questions are a bit hard to answer due to no prior knowledge of vrle	565402-565393-55625318
virtual learning is new for me and therefore answers were given on a suspected outcome.	581929-581920-57302664
no	581929-581920-57348758
No	507662-507653-57654268
Keen to give it a go	507662-507653-57678805
Very useful learning resource.	507662-507653-57682025
I'd probably use it less as i've had a lot of experience with safeguarding and feel relatively confident. I've taken several disclosures and referred and acted appropriately and feel confident in doing so. But i think safeguarding is something that is individual to that person and so if their is a variety of situations to explore it will be a really good tool. As every women is different and her story will never be the same to the next safeguarding concern you participate with.	507662-507653-57682834
I think VRLE is a great idea, my only concern is that every trust in practice has different paperwork/ updates from the next and so if paperwork could be included so we could familiarise ourselves with the paperwork would be good	507662-507653-57691915

nil	507662-507653-57705762
no	507661-507652-58931238
I found use of VRLE at Level 4 very useful as it allowed me to be more direct and push for more information than I would feel comfortable in usually - this really helped to show me what is acceptable in the professional role that I am looking to go in to. I hope that this further use of VRLE will build on the confidence that I gained at Level 4.	507661-507652-58990603
The VRLE is a really useful learning tool that I hope is continuously used throughout the duration of our course.	507661-507652-59064860
no	507661-507652-59096408
I really think this a fab idea! Something health education is really missing	507661-507652-59096679
no	507661-507652-59096724
May use it more as i get used to it more.	507661-507652-59413294
no	507661-507652-59428537
No.	507661-507652-59429688
There needs to be a way that it does not put a massive strain on the hardware used to access it as this is off putting	507661-507652-59465172
N/A	507661-507652-59465173
The only difficulty I have experienced with the app is when there was a lot of us all using it at the same time in a lecture and the programme seems to lag.	507661-507652-59465178
no	565197-565188-59688339
-	565197-565188-59688805
There are alot of features and a lot of downloads which can take up alot of space on a laptop/ smart phone if someone doesn't have this. It also assumes people have internet connections and this again may not always be of access or available to every person.	565197-565188-59682834
The benefits of VRLE use could be great however they are only as good as the software. If it doesn't work effectively - as it appears not to, then very little (if anything at all) is gained from it.	507662-507653-62595230

Appendix 6 continued: merged post -action quantitative data (phase one – this research project)

VRLE post-use (level 4 UK)

Showing 253 of 253 responses

Showing **all** responses

Showing **all** questions

Response rate: 36%

Responses merged with the following surveys:
- VRLE post-use (level 5 UK)
- VRLE post-use (level 6 UK)
- VRLE post-use (East level 4 UK)
- VRLE post-use (Physio students)
- VRLE post-use (PH students)
- VRLE post-use (level 5 paramedics UK)

1 I have read and understood the information provided. I consent to completing the questionnaire.

Yes — 253 (100%)

2 Would you like to use more Virtual Reality Learning Environments (VRLE) for learning / practicing clinical skills?

Yes — 213 (84.2%)
No — 29 (11.5%)
Other — 11 (4.3%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

2.a If you selected Other, please specify:

1 / 14

354
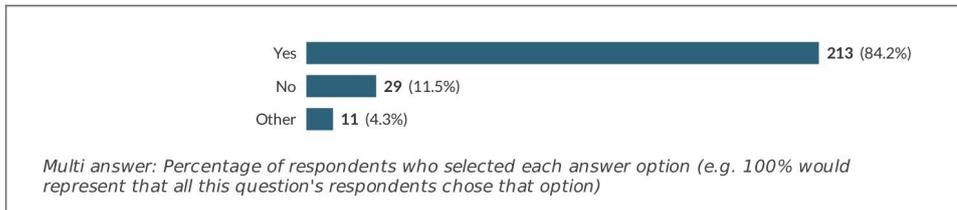
Showing all 11 responses	
I feel for some sessions the use of VRLE would be more relevant than others, for example practice of clinical skills such as urinalysis rather than skills such a gut instincts which can only be fully experienced in real life.	507668-507659-51372138
I think sometimes this will be good but not always.	507668-507659-51383540
For other topics/units also, but I am not too sure it was that helpful, found it more a waste of time in the classroom. But better for others that may need visual help.	507668-507659-51383554
It is very helpful when using at home as it isn't as slow, in the classroom it didn't work very well.	507668-507659-51402335
I did enjoy it however I do prefer to use it at home rather than the classroom.	527861-527852-51637480
I would but not all of the time	507669-507660-51988357
i think they have there place but practical learning and discussion required alongside	581931-581922-57359875
I do find it useful to a degree but dont find it easy to use as someone who doesn't work well with computers!	507670-507661-57696350
Yes if it was better and more sustainable.	507669-507660-59471948
I would like to but if Fieldscapes could be used on mifrosoft 10s it would be easier for me as I could then use on my laptop. It's difficult to navigate on a small iPhone screen	507669-507660-59474390
I think the platform should be more user friendly, it's difficult on a tiny little phone screen to navigate but then doesn't seem to work 100% correctly on my laptop either?	507669-507660-59474644

3   Did the Virtual Reality Learning Environments (VRLE) for safeguarding help you to learn something new? (Yes, no, other – open text)

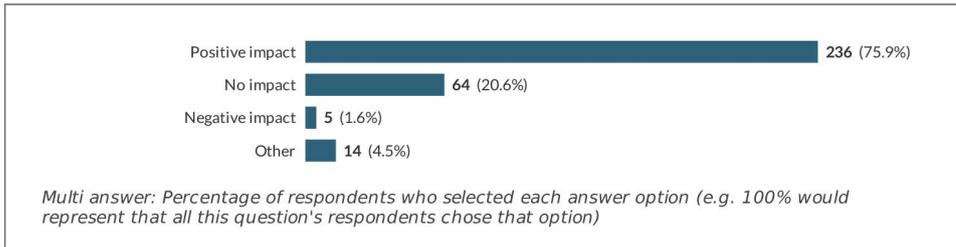Yes   **207** (81.8%)
No   **40** (15.8%)
Other   **7** (2.8%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

3.a   If you selected Other, please specify:

Showing all 7 responses	
It was really laggy and didnt work massively well but was funny	507668-507659-51373345
Not as much as if we were to go through power points or have a go at some activities around the unit.	507668-507659-51383554
It was helpful to be able to see how to engage with the family and address issues without causing offence - however, on my mobile a lot of the questions that I was asked were physically overlapping on the screen so I could not see them which obviously limited my learning. I also am unable to access the VRLE on my laptop - my dashboard is empty.	507668-507659-51424322
Although it did not make me learn anything new, it did make it seem more real.	527861-527852-51636242
I don't think it was new things that I learned but it definitely made me view it differently	507669-507660-51978108
Not necessarily new but definitely reinforced some knowledge	581931-581922-57363303
It reinforces and revises learning from practice so it would be useful as update training alongside core skills	507670-507661-57696350

4   What is your current level of confidence in clinical skills for safeguarding after experiencing the Virtual Reality Learning Environment (VRLE)? (Please rate from 1-10 with 1 being no confidence)

1   **2** (0.8%)
2   **1** (0.4%)
3   **2** (0.8%)
4   **6** (2.4%)
5   **14** (5.5%)
6   **28** (11.1%)
7   **72** (28.5%)
8   **99** (39.1%)
9   **37** (14.6%)
10   **4** (1.6%)
Other   **2** (0.8%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.a   If you selected Other, please specify:

356
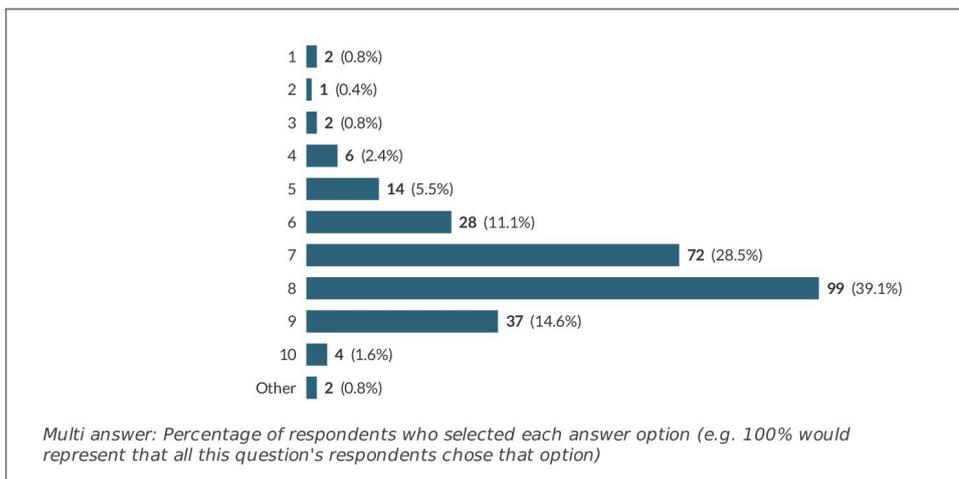
Showing all 2 responses	
I have worked previously in a nursery for 2 years, so this part of the unit I do have a better understanding in.	507668-507659-51383554
My level of confidence has not changed since this session as I found it was ineffective to my learning	507669-507660-59429900

5 Please rate your belief that Virtual Reality Learning Environments (VRLE) can help improve confidence in clinical practice. (Please rate from 1-10 with 1 being no belief)

1 **3** (1.2%)
2 **3** (1.2%)
3 **5** (2%)
4 **11** (4.3%)
5 **16** (6.3%)
6 **15** (5.9%)
7 **53** (20.9%)
8 **77** (30.4%)
9 **46** (18.2%)
10 **31** (12.3%)
Other **2** (0.8%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
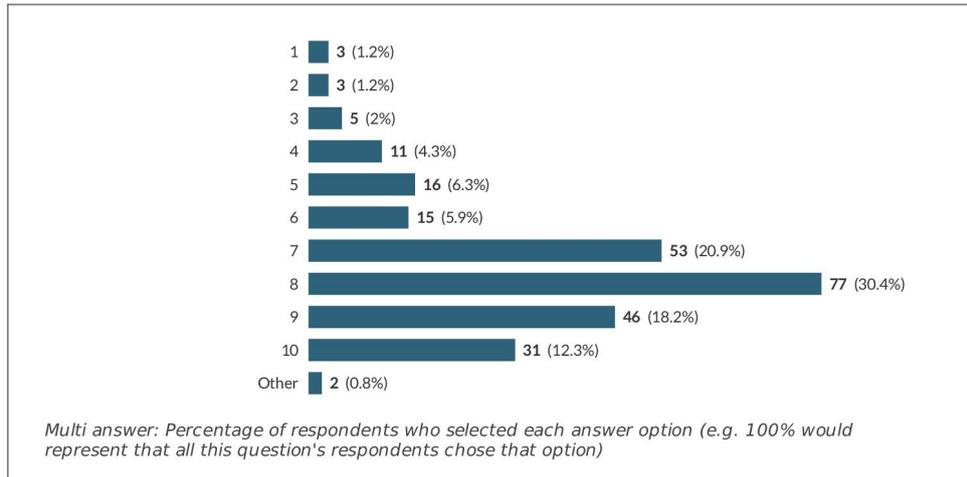
5.a If you selected Other, please specify:

Showing all 2 responses	
They are good but quite glitchy	507668-507659-51373364
I think they can, but there needs to be more information available within the VRLE, like what each referral is for etc, that would be more helpful. Also maybe hints and tips.	507669-507660-59474644

6 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) helped to bridge the gap between theory / practice. (Please rate from 1-10 with 1 being no belief)

1		3 (1.2%)
2		2 (0.8%)
3		3 (1.2%)
4		12 (4.7%)
5		24 (9.5%)
6		16 (6.3%)
7		40 (15.8%)
8		76 (30%)
9		53 (20.9%)
10		30 (11.9%)
Other		0

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
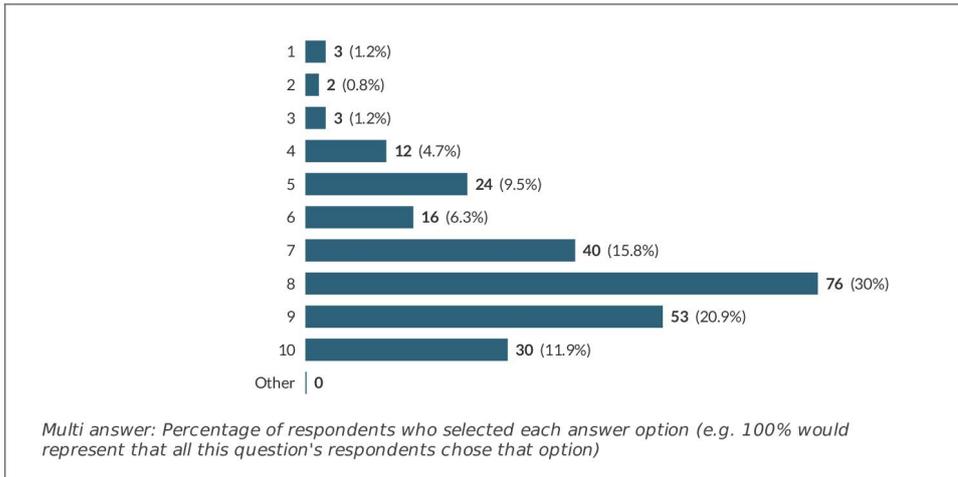
6.a   If you selected Other, please specify:

No responses

---

7   Please rate your belief that use of Virtual Reality Learning Environments (VRLE) for practicing clinical skills helped you with learning to use intuitive practice (using your gut instinct). Please rate from 1-10 with 1 being no belief.

1		2 (0.8%)
2		8 (3.2%)
3		2 (0.8%)
4		12 (4.7%)
5		24 (9.5%)
6		21 (8.3%)
7		35 (13.8%)
8		70 (27.7%)
9		46 (18.2%)
10		32 (12.6%)
Other		3 (1.2%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
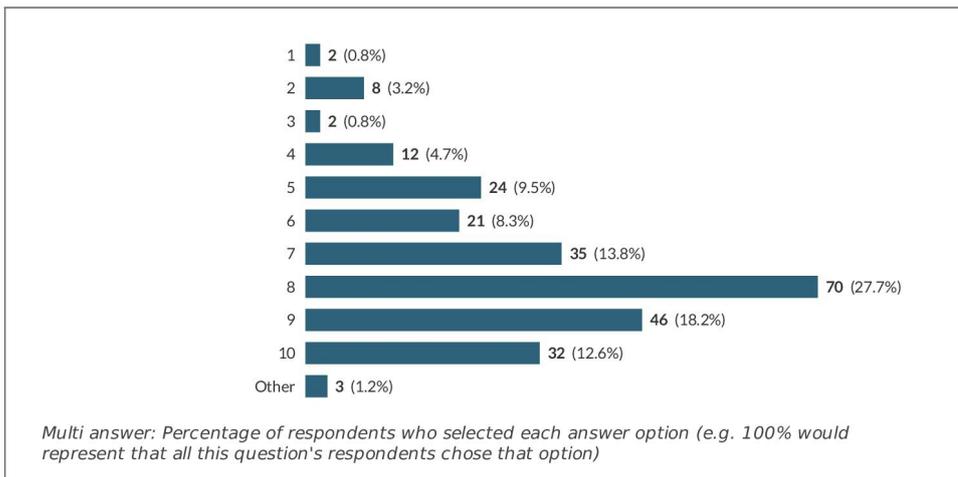
7.a If you selected Other, please specify:

Showing all 3 responses	
-	527861-527852-51637456
I did already use gut instinct in practice in regards so safeguarding concerns	507669-507660-52781963
Although I understand the concept of the VRLE, I struggle to link it with real life situations and it is also very unclear to see stuff, like bruising, red eyes etc. unless you are told about it.	507669-507660-59474644

8 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) had an impact on humanisation (the 6 Cs) of your healthcare skills.

Positive impact 197 (77.9%)
No impact 58 (22.9%)
Negative impact 1 (0.4%)
Other 2 (0.8%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
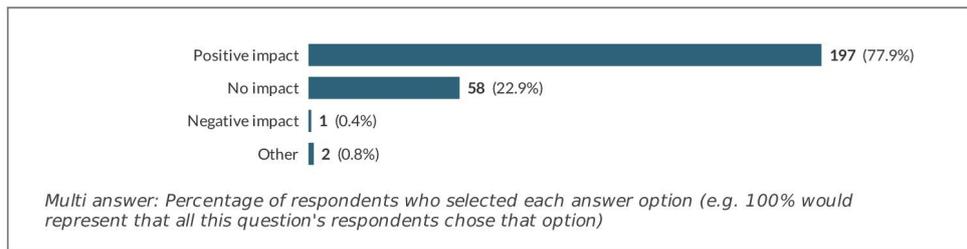
8.a If you selected Other, please specify:

Showing all 2 responses	
I think it can help some of them	507669-507660-59110785
Can have both negative and positive	565198-565189-59700094

9 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) had an impact on your learning?

Positive impact 217 (85.8%)
No impact 35 (13.8%)
Negative impact 2 (0.8%)
Other 0

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
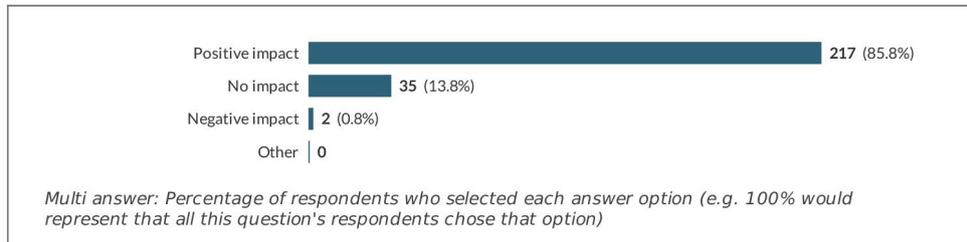
9.a If you selected Other, please specify:

No responses

---

10 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) had an associated impact on patient safety.

Positive impact ████████████████████████ **215** (85%)

No impact ███ **37** (14.6%)

Negative impact █ **3** (1.2%)

Other | **0**

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
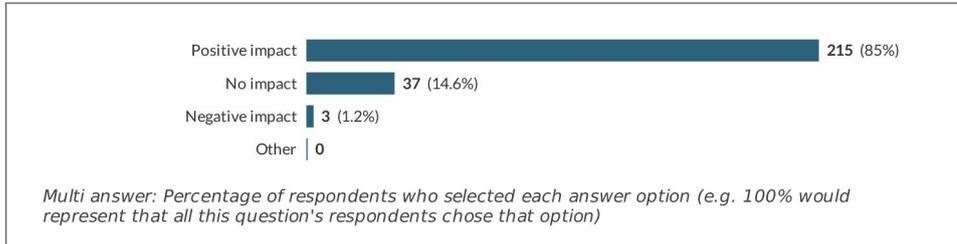
10.a If you selected Other, please specify:

No responses

---

11 How many times did you use the VRLE?

1 - 3 times ████████████████████████ **210** (83%)

4 - 5 times ███ **39** (15.4%)

6 or more times █ **4** (1.6%)
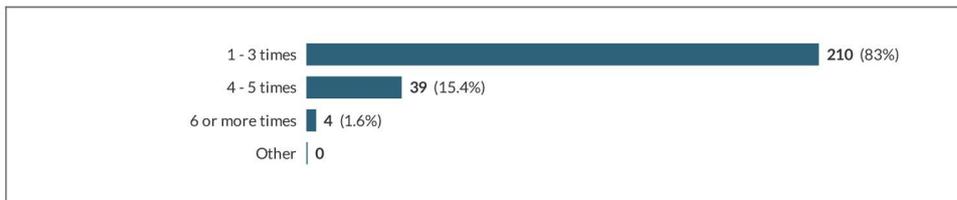
Other | **0**

11.a If you selected Other, please specify:

No responses

---

12 How long on average did you use the VRLE each time (please also select 'other' to explain why).

1 - 5 minutes	8 (3.2%)
5 - 10 minutes	38 (15%)
10 - 15 minutes	68 (26.9%)
15 - 20 minutes	63 (24.9%)
20 - 30 minutes	50 (19.8%)
More than 30 minutes	35 (13.8%)
Other	9 (3.6%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
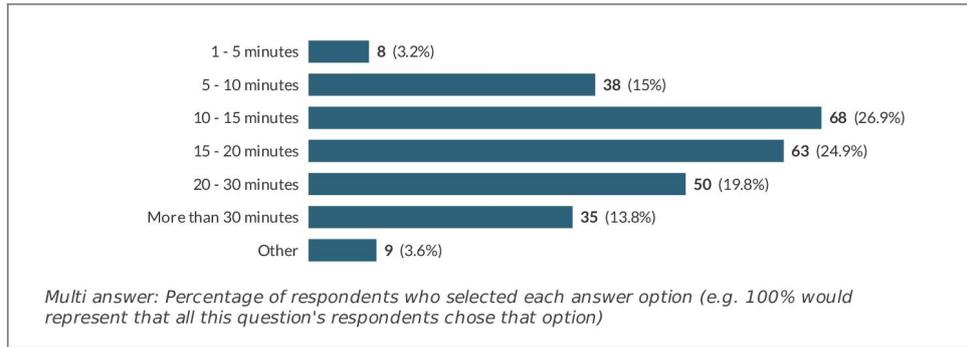
12.a If you selected Other, please specify:

Showing all 9 responses	
Drains battery of phone very fast and makes it very hot	507668-507659-51373364
It drained my battery something crazy dude	507668-507659-51373370
Phone got far too hot to continue using it for a longer period	507668-507659-51373278
Made me feel a little bit sick if i did it too much	507668-507659-51373686
1 hour	507668-507659-51383540
1 hour	507668-507659-51383554
I explored around the house and had a look around as well as talking to the people in the house	507669-507660-59472426
Quite a quick scenario with not a huge variety of options so didn't take long.	507669-507660-59474390
Two sessions neither of which I could access or use at the time, become very upset that this has happened twice now	507669-507660-59475453

13 What device(s) did you use for your VRLE experience?

I experienced the VRLE using a headset (Quest, Rift, Cardboard, other) — **41** (16.2%)

I experienced the VRLE using a handheld mobile device (phone, tablet) — **154** (60.9%)

I experienced the VRLE using a PC or laptop — **108** (42.7%)

Other — **1** (0.4%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
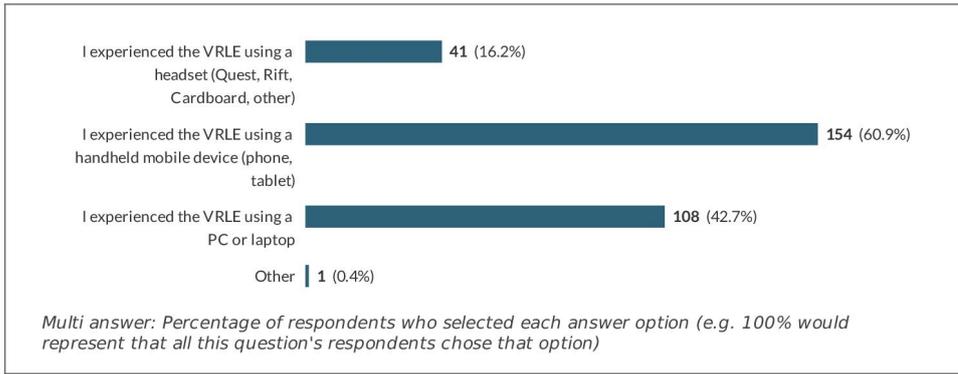
13.a If you selected Other, please specify:

Showing 1 response	
It took a long time to download on my computer, the app is easier but uses so much battery	507670-507661-57696350

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14 Would you like to tell the researcher anything else?

Showing all 75 responses	
Using my phone, some of the text overlapped which was difficult to read so i found myself missing important text. Also very slow, and hard to use on a phone.	507668-507659-51372889
N/A	507668-507659-51373345
Good idea	507668-507659-51373364
I found it quite difficult to navigate as all avatars were in the same space, so it was crowded and because of this I couldn't get past the front door and really experience the VR.	507668-507659-51373241
I think there are some glitches in the system, which need attention. Some of the text in the boxes overlapped so I was unable to read all of the bulleted options, and also I had to exit and go back into it because it froze and I was unable to continue which was frustrating.	507668-507659-51373263
Really useful. Gave me a better understanding of how to handle safeguarding issues in practice	507668-507659-51373362
N/A	507668-507659-51373443
Very slow, lags and not fully explained	507668-507659-51373481
Perhaps improve it when multiple people are using at once. Seemed to go	507668-507659-51373599

~~...~~ down when a lot of people were on.	~~507668-507659-51373686~~
Felt this is a really good way to teach as it kept me engaged in theory and practice	507668-507659-51373686
Battery life o phone went down very quickly	507668-507659-51373768
Disappointed the programme doesn't work with Microsoft windows 10s. When using the app on my phone; when given multiple choice options of what to say/what my concerns are the writing overlaps so I can't read the text options and don't know what I'm choosing. We have spoken to developer Nash about this.	507668-507659-51373631
None	507668-507659-51383554
Navigating on the phone wasn't the easiest	507668-507659-51384981
It was a new interesting way of learning.	527861-527852-51637480
-	527861-527852-51637456
.	527861-527852-51637500
The software did drain the battery quite a lot on the computer so would not want to do a more in-depth scenario in the classroom setting. I thought that it was really helpful to go through this as I was reluctant to ask further questions but felt like the scenario guided me through to ask more and it was a safe environment to do it in. It also helped to confirm that we should not make snap judgements as things may not always be as they first appear.	527861-527852-51637570
It was fun.	527861-527852-51637682
I liked the feedback during the VRLE as it helped give pointers where I went wrong or that I had made the right decision.	507668-507659-51637762
Trying to download took hours as my devices and antivirus kept throwing it out and not allowing. Halfway through experience each time used it I kept getting put back to beginning very frustrating. Always in the same place	527861-527852-51637604
Some things I said I don't feel I would say in real life - for example saying I've noticed its cluttered or the cannabis plants on the floor. Knowing the woman could get violent I wouldn't feel safe saying some things.	527861-527852-51637638
when first installing VRLE, anti-virus software kept seeing the program as a threat and kept quarantining fieldscape. Has to reinstall it about 4 times. On the fieldscape tutorial instructions were not always clear or how to achieve something. For example 'jump on the white hoop' but no instructions on what keys allowed you to jump onto the hoop	527861-527852-51637704
I feel i was more abbrupt with the queations and may not have asked them if i was physically there in person	527861-527852-51637860
Really enjoyed this session and was very helpful to have the VRLE. Very much suits my style of learning.	527861-527852-51638485
0	527861-527852-51638968

N/A	527861-527852-51638952
No	527861-527852-51639214
It was first timer using VRLE and before I was a bit sceptical and did not think it would teach be anything or be useful however, it taught me to not be afraid to ask questions as long as they are still professional after all we have a duty to safeguard.	527861-527852-51650199
I found it helpful to just be able to see more of the situation. Normally safeguarding situations are described or written. It's much easier to observe interactions between people or watch how they interact with their environment and how it changes when others come in. This was enhanced using the VRLE	507669-507660-51978108
no	507669-507660-51988313
I did enjoy it but wouldn't want to use it all the time in learning	507669-507660-51988357
I really enjoyed using the VLE	507669-507660-51988537
Found it really useful and made me think about what I would do in safeguarding situations	507669-507660-51988427
It was unclear what to wait for next, I would read the text and advice then not know what to do next, each text should lead on to the next direction	507669-507660-51988664
N/A	507669-507660-51988587
I personally think that the current form of VRLE and topics addressed within it at this time would be most effective for a first year student midwife before they have gone out on placement and experienced being in women's homes, to help them to gain experience in what to look out for and the give an insight. However for our current level of practice I felt it didn't increased my knowledge.	507669-507660-51988341
I felt I learned from the real life scenarios and would find this easier to remember in practice.	507669-507660-51989049
Although there were a few gliches I can really see the benefit of using VRLE to enhance learning. It was good to experience a potential situation and made me think about how to say things when put in a confrontational situation. I didn't have enough storage on my mobile even with removing a load of apps so couldn't experience the VRheadset and did find that it drained my laptop battery.	507669-507660-52005398
Really enjoyed this method of learning!	507669-507660-52781846
The VRLE is a fun way to learn but felt I would have learnt more through other interactive methods or powerpoint. I didn't feel that the VRLE taught me more than photos and class discussion would have, which would have given more time for going through other things	507669-507660-52781778
I needed a few breaks during the headset use, as it made me feel a little sick (reminiscent of travel sickness,) but I enjoyed the overall experience. A few teething issued such as links being hard to click on and some issues in the VR environment being unable to be selected, but overall very happy	507669-507660-52781835
I enjoyed using the VRLE however I feel technological improvements in it's appearance may make the experience more enjoyable.	507669-507660-52781824

I wasn't able to explore the Parvell house without interaction with Natalie, a few things got brought up in the feedback session which I had missed due to following the instructions. I was also unable to use the alarm bells at the relevant parts, I.e I clicked alarm bells for the bottles but it came up with the bruising information.	507669-507660-52782001
Found when alerted the alarm bell the dialogue box was blurry and unreadable, therefore leaving a poorer experience when using the VRLE. Also, if you did click the alram bell/ gut instinct it didn't necessarily relate to the issue I had pressed it for. Also, in the Parvel VRLE it asked for example if we would accept a cup of tea, and the options to choose from were, I felt, both irrelevant to my reasoning. Some of the maneuvering was clunky and the 'uncle' had half his legs stuck in the sofa - I concede that it is early days for these learning envirnments	507669-507660-52781786
There are still a number of kinks in the programme and the table to select which services to refer too, was unreadable. It might be beneficial to have more options for actions available to the MW/HV and the possible implications of those actions once chosen that path, even perhaps an entire pathway of how badly it could turn out ie dad becoming aggressive so you have to leave, or another route whereby your actions don't provoke etc.him	507669-507660-52781870
some of the text was unreadable. Sometimes when clicking on the alarm or the gut feeling to something you had just noticed, the text that came up in response was not always relevant to what i had seen. walking around was a little bit 'clunky' and not as easy as id like to maneuver the time it took to log in to the VRLE was also really quite long, and sometimes it completely froze meaning i had to start again from scratch.	507669-507660-52781803
Too long and complex to set up, would have much rather just put in the extra effort to have a physical lecture or just voice recorded one	565403-565394-55670800
Uses a lot of laptop energy!!	581931-581922-57363303
A nice foundation, but certainly lots of room to expand the grey areas.	581931-581922-57361441
It is ok as long as your computer has the capacity as sometimes it could be quite slow and drained my laptop battery but otherwise worked well to improve my knowledge/ skills and confidence in these cases if I were to come across this in practice.	507670-507661-57693486
I thoroughly enjoyed this one today	507670-507661-57696419
Very glitchy, found I was going through walls or getting stuck a lot. A good premise but hard to use and frustrating due to glitches.	507670-507661-57696745
A good platform for distinguishing safeguarding issues	507670-507661-57696857
nil	507670-507661-57696872
Good platform for distinguishing safeguarding issues	507670-507661-57697143
no	507670-507661-57696641
I think this is a great way of learning. It allows you to think carefully and appropriate ways of approaching questions.	507670-507661-57697113

I think that it would be good to try and set up your own responses rather than clicking pre-set ones if there is a way to do that somehow. I found the software difficult to move around and work but this might be easier using a headset rather than the mobile device. I did like the way it had links to resources.	507670-507661-57696337
NO	507669-507660-59110749
it gives you experience that you may not see in practice	507669-507660-59110817
I think the VRLE is the perfect way to teach students how to respond to parents and how to approach difficult topics. I find identifying the concerns quiet straight forward, I have 2 children and some education around child's health etc so identifying issues isn't a problem. Approaching them is very alien to me. I'd love to use this more to see examples of how what to say/ how to phrase things etc.	507669-507660-59110785
I really enjoyed the VRLE it is a fresh new way of learning and really helps put yourself in the environment.	507669-507660-59110851
I had some technical problems such as having to redownload the app and possibly losing WiFi which meant it froze and I had to restart! These were quite annoying however when it worked it was good.	507669-507660-59110883
I think that the system is slow and ineffective and I do not think that it should be the only option for learning sessions. Although some people may like these sessions and find them beneficial, others don't and I feel it is not an effective way to engage their time if they don't find this resource useful	507669-507660-59429900
N/A	507669-507660-59471858
it did glitch a bit	507669-507660-59471868
Really helpful resource	507669-507660-59471944
It would be handy if you could take notes as you go on the VRLE, of things that are of a concern.	507669-507660-59472316
Please make it more sustainable and flow better as very glitch and jumpy	507669-507660-59471948
Personally I did not find this helpful, maybe because everything is online at moment. It didn't make much sense without the full classroom based lesson to supplement it. Came away feeling more lost with it all	507669-507660-59474329
Would have been better to have done the work when I accessed it two nights ago, or if the work was accessible prior to session, for me.	507669-507660-59475453
I think the VRLE was great! It worked perfectly on my laptop and had no technical difficulties at all. It was really helpful using the multiple question on how to respond. I think you should ignore the people who had technical difficulties as this does not impact the positive experience and the learning that can be achieved by using VRLE. Would love to have more examples to be able to use in our spare time.	507669-507660-59480748
It might be helpful to have different families with less obvious needs sometimes	507669-507660-59480795
Thankyou for the experience!	565198-565189-59691974

Page 14/14 is blank and therefore not included in this Appendix.

Appendix 7: post-action (phase one – this doctoral research project) qualitative data

Transcripts of 31 RPs contributions during focus groups,
Transcripts from 3 RPs who chose to contribute written feedback rather than attend focus groups and open text feedback from quantitative data collection
XXX = segment deleted to maintain location or other confidentiality.
… = pause by RPs while speaking

1.	C: ummmmm *raises eyebrows and smiles* I didn't have sound on mine…. I don't…. no, I didn't have sound on mine. So I didn't completely get it.
2.	H: Mine worked really well apart from it just made my computer super hot. *smiles*
3.	V: , mine did that too and it really drained my battery. *laughs*
4.	C: I do remember I did mine on the phone and it got very hot
5.	L: I had the same with it draining the battery so it was difficult if you can't plug in your laptop when using it but apart from that I had a good experience.
6.	V: , I've done…I did it on my laptop in Uni and then at home so I was plugged in and didn't notice that it was getting hot or draining the battery so that was fine. but it was just in class because…
7.	C: I don't know if it was the same…
8.	V: …there's hardly any plug sockets in XXX.
9.	L: Same in XXXX
10.	V: Is it *laughs*
11.	L: Yeah *sighs*
12.	C: I had it plugged in at home as well but I couldn't plug it in in the classroom where we were using it
13.	H: I used my computer at home and it just made my computer hot and then at uh Uni I used my phone and it drained my battery really fast *looks at ceiling* *smiles*
14.	V: Ummmm I thought it was really good. On the Melser one I felt like I like was prompted to ask more questions in it than I probably would have done if I had been there in person. So like pushed them further with asking the questions and that kind of thing.
15.	H: *nods*
16.	V: So it was kind of like the safe place to do it. *nods*
17.	C: *nods*
18.	V: Yeah so like maybe one step or one question further than I might have done and I think it's because that was sort of like my first real life experience of

	regarding safeguarding questioning that I've had so it was good to sort of test it out in a in that kind of environment before we went out on placement. *long pause*
19.	H: I agree with that, definitely. I thought it was really good, I did actually think it was really useful to do like before going out … and before going out on community placement especially where obviously we're going to people's houses and things so kind of it was good to see how you should react to people in their own homes and what the normal questions were because some of it is a bit sort of… m weren't the kind of things you'd normally talk to somebody you didn't really know about …so mm….that was quite……I think having the feedback as well…click an answer and it says like that's fine or no don't push them that far is quite helpful to know as well .
20.	C: I agree about the feedback *nods* it was good
21.	C: Multiple choice questions (feedback), for me.
22.	L: Yeah
23.	V: Yeah I agree
24.	C: Yeah
25.	V: I think where I did the gut instinct or alarm bells quite a lot and ehm it was like a oh ! I got that right like that was good but then a few times I clicked it and it was the same and I was like oh I need to stop reacting to everything
26.	C: *laughs*
27.	H: *laughs*
28.	C: I had that as well
29.	V: *Laughs* Ok that's good! He's still doing karate in the corner!
30.	L:*Laughs*
31.	V: No I think it (gut instinct and alarm bells opportunities) was in there enough but it was just like I think maybe I'm just getting used to like if I said something once and done your gut instinct thing then you don't necessarily need to do it you just need to remember that adds to that one thing maybe? I guess what I was also wondering is I picked it for these things but have I missed any other things? And I don't remember having feedback on that like any I've missed.
32.	L: That would be a good idea. I think maybe both.
33.	C: I think maybe both as well because sometimes in the classroom it was like difficult cos there were like technical issues so it would be good to ideally have it in the classroom but if you're going to practice this at home it would be good to ideally have it in the VRLE as well just to help us practice. if we hadn't pressed gut instinct or something after a while maybe if it came up like something in the corner to say we should have picked up on that…things we might have missed…it didn't actually tell us if we've missed anything

34.	H: Uh hum
35.	C: I thought it was a really memorable way to learn. I mean that I find I can remember clearly a lot of what we learnt through the VRLE I think because it's going into a space and making decisions like that that I find it easier to remember than maybe other information that you're given over safeguarding. Perhaps because it just more mimics a real situation more
36.	C: Absolutely. Because I always think safeguarding is a really hard thing to learn how to do. You can learn the theory of safeguarding but actually to go in and be making decisions like that is a really good way to learn. I really liked it.
37.	V: And I think also like even in just the first week of placement there's been a few people that have had slight safeguarding things going on. I think the VRLE like really reflected how it's not just one thing that people have going on, there's multiple layers of things and it I guess when you're doing the theory you kind of think oh I could pick up on that or would notice if there were like this going on but it's like remembering that there's this whole world around these people so different stuff is probably happening so that's quite useful to experience before we went out in placement.
38.	H: I thought it was good having lots of different characters as well all in the one family and that some are more difficult to deal with than others which I think is very realistic and with the theory you sort of think that maybe that… there's gonna be… you know that there's gonna be a shrinking violet woman and quite a domineering man just because of all the theory and actually having it the opposite I thought was quite good and just the different personalities in the characters came out…which was nice. It did make it very realistic.
39.	C: No I agree with what the others have said. It was…I found it um…it was actually quite good. It was not something you could have got in the classroom. It was kind of like…I know it was 3D but it was like being there
40.	V: *Nods*
41.	C: So it was good and the feedback as well was a big thing for me. Knowing if you'd said the right thing….
42.	L: I thought it was good at making you question and not taking people at face value which is something I am not very good at so you know people are slightly resistant to your questioning to make you ask or try a bit more and you know why aren't they sort of you know cooperating and letting you see the baby or something like that. I think I learnt a lot from that.
43.	H: Ummmm *nods*
44.	V: I think it was useful to have to get used to have conversations with people with the TV on? I have been astounded by the number of homes we've gone into that the TV is on the whole time you're there.
45.	C: Yeah I agree, yeah
46.	V: The midwife's here, turn the tv off! *laughs* Yeah
47.	H: a few people commented on that actually when we were in the classroom and saying all they can hear is this wrestling happening but you're right when we go into people's houses there's often lots of background noise or like

	toddlers playing and it is sort of difficult to focus on what you're meant to be doing and what you're talking about so that was very useful actually
48.	C: we had quite a good one today when I went on a visit today one of the toddlers had an accident so we were all quite distracted for a while
49.	V: Uhmm Denyse you we went back to like err at the end sort of having like a wash up thing? I also wondered if there could be something to say like you go away and this is what you do to take it that one step future so you go away and you do your referral to MASH or whatever just to…
50.	H: *nods:
51.	V: round it up and summarise it.
52.	L: I agree I think that would be really useful.
53.	H: I think it made me…it prepared me for how some people are gonna be more difficult than others h and that some of the conversations that you might have do seem a bit the midwives have do seem a bit like prying into people's into people's lives but that's normal and that's ok. Because I think it's not your everyday conversations I suppose so that's helpful and … the fear of going into people's houses which is kind of a strange one as well so that was helpful.
54.	V: I did the urinalysis VRLE one as well and I found that useful just to refresh the learning we'd done in the classroom before going out on placement because it felt like we did that so long ago that initial training session so just going back into it and even like things like checking the date on the pack and that kind of stuff that the VRE takes you through I just think those little bits you're more likely to remember if you've done it in the VRLE
55.	C: I found that it made me kind of question everything like if we couldn't get hold of a mom like she wasn't texting back or something like that it made me question everyone who wasn't answering the phone or getting back to us like why are they hiding. So it's kind of I think probably because we are very new to it and the gut instinct will maybe kick in as we get to know it a bit more… to be midwives a bit more but it did make me kind of start questioning every time someone didn't answer a phone or reply to a text but I am in a high risk team anyway looking after high risk women for things like domestic violence mental health young mothers and things like that
56.	V: I learned about the phrasing of questions. And the sort of order that you would ask things in. I feel like I haven't learnt it all yet but understand that there is a process to go through. And it was interesting both times I did the Melser family one I know I clicked the same answer and it said no that's not right get on with the booking you've got lots of other women to see and actually what it kept telling me was like it's really important you need to do it. So I've learn't that you need to give the (health service user) time, it's really important to do that.
57.	C: following on from that it is important to give time but then a lot of the midwives I've been working with have been saying but we haven't got the time to give that extra time sometimes so things are rushed and it…how do you change that?
58.	H: I think when we were in the classroom and there were lots and lots of students all logging in at the same time in the Melser house that was quite

	frustrating because you couldn't move anywhere and that seemed less real than when I did it at home.
59.	L: It was very funny.
60.	C: It made a big difference to us to not be able to see the others while we were using it.
61.	L: How do people fly I don't understand? (Question answered)
62.	V: I think it fell like enough. It was a good length of time, it took like 25 minutes to do and just adding on those little bits of the feedback that was probably as much as we could have got out of it. I think.
63.	C: No I'd like to see something else in it. I think you said there's another family coming up?I think as very green first year students where you had two choices of what to ask or how to ask the question, I thought that was quite good. And the prompts asking the questions in the right way… things that I wouldn't think of and I'm sure that'll be the same next year, things I wouldn't think of but it was definitely good before we went out in clinical practice
64.	H: I tried the headset glasses, it was really strange because I haven't done anything like that before but it was kind of cool but I felt like it was harder to move though with the glasses though whereas on the computer it was a lot easier to move around and to click on things but that could just be me being a bit of a technophobe so
65.	L: Yeah I found clicking on things made me bump into the furniture a lot and I spent a lot of time just trying to get around the furniture when using the arrows, I did find those quite difficult to use
66.	H: I thought it was really helpful and I actually found it kind of fun as well which was nice so I would definitely do it again
67.	V: It was kind of like because we'd done the adult safeguarding and then the child safeguarding session it was kind of a nice way to finish the day because although we were doing safeguarding it wasn't like Oh god that was awful it was sort of more interesting
68.	C: Yeah, light.
69.	V: Yeah and also Safeguarding can feel overwhelming because it is rally important that you get it right and such a responsibility that we'll have but when you clicked that list and it had all those people you can refer them to and those people that can also be involved in it it's like not just you, it's not on you to fix all these problems so that was good
70.	L: Yeah
71.	H: Useful out in community as well because I have had a safeguarding meeting and seeing how everyone does interact in real life it was quite nice to see that there was all those options as well beforehand rather than going there wondering oh my gosh who are all these people? Instead it's oh, I've read about you!…. and it was nice in the VRLE to click on who I thought they should be referred to as well.

72.	B: for me it was a way to be able to get into the actual situation, a way to visualize what a situation can be really and how you would react to it
73.	C: I think that would be fairly similar for me as well. I think it's…you talk a lot about safeguarding, um and different situations but it's actually quite hard to visualize the kind of environments that you might be going into and I think that it was interesting how many questions were appropriate to ask and it was kind of interesting the line of questions that went on and knowing that you could be kind of that inquisitive and asking you know trying to find out as much as you could.
74.	B: Yeah yeah yeah I agree I mean you hear a lot you read about a lot of situations but it was good to see it was good to see to be in a sort of situation without being…with being safe if that makes sense and see where you can go or what you would do
75.	R: yes for me I mean one of the things that really that really kind of gripes me about safeguarding training m *clears throat* I mean I have probably done safeguarding training every year of my career since I was probably 15 and I…it does my head in when we would do like scenarios and stuff and you'd have to paint quite a detailed picture of someone's life in order to get your head inta what may or may not be going on…and it's all very theoretical h…and in a kind of I don't know in a classroom environment, a meeting room or whatever you might be talking about something and others will add their own "oh you know I had this family and" it's hard to kind of get a sense of that family and actually when you walk into the virtual… when you walk in using the VRLE there is no one else who chips in and you literally, it's so much more realistic than having a classroom full of people who are…who are kind of going "Oh well when that happened social services weren't interested" or "oh in my school" and all those little chips in are really important and valid points but I'm not sure you, as a student, learn as much as being in the situation and one of the things that …that really stood out for me, and I have been ming and ahhhing over whether to share this with you *laughs* 'cos I think I come off really badly in this m but I when I was a kid…the first time I ever experienced poverty like really real real poverty, I was at a friends house and she wanted to take me to see another friend and when we went through the door I burst into tears because I just had never experienced anything like it and it was so shocking and one of the families on the VRLE it made me laugh because made me think of the house….it was that, it was really similar and you know I was quite young at the time and I was just in shock and I didn't know what….what to do with that and I think that situation where I was so shocked when I walked in that house and burst into tears there was no one else there and no where else to go with those emotions and that feeling and I think actually having an opportunity to do that in a virtual situation you might not ever have seen a household like that in real life but if you walk in and you see it and you think really?
76.	B:*nods*
77.	R: and you come across that for the first time in practice and you think oh my goodness actually I kind of have something to pin it on. You think there are no parents in this house…why is this child at home…why are they not dressed properly…what is that smell…all those kinds of quite shocking things that
78.	B: ummhumm
79.	R: they could really floor you actually the first time you experience it. Like you think about sometimes you walk into a household that sometimes… *deep breath* full of pets… and maybe carpets that have not been renewed or

	replaced or cleaned regularly and actually that quite overwhelming and shock factor if you haven't experienced that before and you really don't want your face to be obviously like "oh my word, what's happening" *laughs*
80.	B: yeah
81.	C: yeah
82.	R: I found it quite helpful in terms of that…my learning enabled me to get into that zone of "there isn't anybody else here" it's down to me and I've got to make good judgement calls here and that's really helpful to me
83.	B: Ummm, I think that you want to be able to almost have the situation to practice on if that makes sense without it being real so you don't come across as unprofessional because for them that's their norm to have probably no food, or no clothing, no hot water while to us we lucky enough…we know there is a welfare issue and while I was in welfare training I often thought well how would you react? I know you tell me to react like that and this this this but if you're personally confronted with a situation how would you possibly react? And having this VRLE it does open your eyes as well because I was a bit naïve to think it shouldn't really happen in England and yano why does this still happen in any country really and to be abe to sort of…to see different scenarios and almost give you an option to ….you could do this, you could do that this is who you interact with a person who doesn't want to interact with you or is very angry or has any other issues…m I think helped me to have a wider view of certain situations and not to be tunnel visioned if that makes sense? So ummm yeah
84.	C: I think…
85.	B: yeah go on…
86.	C: I was gonna say I think it is interesting because having gone out on placements…Different practitioners do react in different ways and I think that within…I can't remember my exact choices within the app that I made but you could definitely see that there were choices and that they were different ways of perhaps handling the situations and that's definitely…I noticed that out on placement that there are no right way of doing it and that there are different routes you can take like different to how you would practice
87.	B: and every scenario is different…you might…would call early help with one situation while a different action is needed for a different family so but of course I'd still sort of talk to my peers and said what did you do there? What did you do and I was still surprised because it is not that obvious?
88.	Moderator question shown to add context to response below: your peers that you spoke to, did they all help the family?
89.	B: They did, . In different routes or the conversation was open as ot which route was quicker, of course there's no right or wrong answer to this because it's really depending on who you get on the end of the phone or who is more proactive or is the school well involved or not. So I think you would still hit hurdles along the way but I think everyone did something and I think that was good to see…everyone triggered you know…alarm bells in one way or another, intervened with early help or mental health or something and so that was good to see but I was still surprised to see how difficult the situation was which I think in hindsight could reflect on how…. I think the virtual room helps people to visualise it in a much better way.

90.	R: One of the things I found really helpful about the questions and the feedback we got from the families was um was a couple of times that I chose to do something because of…I felt like it was the right thing to do and the feedback said "yes, correct because this is going on" and I thought "oh flip" I hand't even noticed that! *laughs*
91.	C: *laughs*
92.	R: I hadn't…I hadn't…and it made me think of something else like…like it just made my world view go kind of *spreads hands apart to show increasing size*
93.	C: Yeah!
94.	R: Because I'd made that judgement call based on just kind that's what I'd do….rather than what was actually happening and I guess some of that's just because it's people and you know roughly what the right kind of thing to do is but sometimes it came right down to where's the level of harm…how urgent, how severe and how to kind of pick those things out because there is a lot of alarm bells but some of them were so irrelevant in comparison to the major "banging gong" over here…um and that's . A couple of times I was like "oh I'm going to this, oh there's this that has to be done, good point!"
95.	B: *laughs* I have to agree I found the same really…I didn't even look into that…I was just so fixed on him not hurting himself or him not attending school than what the mom was saying afterwards. What I found tricky was answering…do you carry on the conversation or stop? I was like well surely you want to find out more but the answer is no you stop and I was like "really? Ok, so where do you go from here?" and of course you don't want to come across as being the authority because it's their home, their territory so it's almost like you have to just step back a bit to realise that you're coming into their home and you need to look at the view much wider, a wider picture than the tunnel vision.
96.	R: I wonder if it is one of those things where in the situation the VRLE gives a much better idea of feeling uncomfortable like with another person coming into the space, they're very close to you…you kind of start feeling "oooo I don't like this" that's easier to see and feel than in a case study or with someone talking about it. The only other way to emulate that is role play and lots of people are uncomfortable with role play so that one I think maybe it's a downside of the VRLE that maybe you don't pick up so many cues because obviously they are androids running round so you don't pick up those nonverbal cues of I think I've got enough here that I can move or and leave because there is a bit of that disconnect but you do get that sense of I want to move because I am uncomfortable which is what you do take into practice
97.	C: Yeah
98.	R: I'm not comfortable and someone is now in that space between me and the door. I'm gonna move round the sofa.
99.	B: yes, YES!
100.	R: I'm getting into a different space now, I'm not comfortable here.
101.	C: Yeah.

102.	R: and I guess it just kind of opens that door to go "how do you feel about this?"
103.	B: I was surprised how my gut felt, how, how, I mean I go often from my gut I think "oh I don't like this" and in the VRLE I couldn't see anything obvious but even so something told me in my gut that something wasn't quite right and even in that virtual world I thought "oh my gosh" it still sort of works to trust your guts. m, but then I've spoken to some of my peers and I don't know if it's yano they didn't have enough experience of life that they couldn't pick up the cues…does that make sense
104.	B: the much younger ones were like "oh it was just *shrugs shoulders* the kid messing around" and they reacted because they knew it was a welfare issue they were almost prompted to look for the wrong if that makes sense (because it was a safeguarding themed VRLE) so that was quite interesting to hear that some of them were thought of it as " but you know…I skipped school" and I was like "hmmmm but there's more to it than just skipping school" once or not having food or yano so that was quite interesting to hear actually.
105.	R: I did wonder…I have the benefit of coming later into midwifery and I've worked with families for a long time so I have met different characters ad I don't know, it might be interesting to find out from the girls who are younger… in ts of would they look at a charming man differently? Would they recognize and acknowledge that with that family this is really quite an abusive situation…both mom and baby's life are in danger right now and quite urgently for baby? *laughs* And ummmm uh for me in terms of gut instinct when I'm in placement aggressive men in labour rooms don't stress me out really m charming men really stress me out quite a lot and I find that quite… kind of something kind of goes up within me because I am like "ooooooh why are you being?"…if someone is trying to romance the room then I am kind of…that's why…I've met one or two very charming, very affluent men and I know that yano once or twice students have told me about doctors who have come in the room and they have come in with their Trust lanyard because their wife is in labour and they have worn their ID badge the whole way through, oh one of them kept turning round to make sure everyone knew because maybe if it turned the other way round then no one would know this person was a consultant and needs to be taken seriously. His behavior didn't really wind the midwives up but those kind of things really bother me but I wonder whether this would have that level of impact and now you know whether this VRLE would have opened people's eyes…and if you've not come across people like that then that's quite hard to spot.
106.	R: and in the VRLE he's a bit like "it's all very nice and wealthy in here thank you very much by bye shut the door". And that should set off so many alarm bells for everybody especially when he's saying to the healthcare professional that he knows what he's doing and you're like "um you're not the expert here actually".
107.	B: I agree I think I was fortunate enough to work at a different Trust so I think I sort of had to find I was shocked at how many different situations you come across at booking or just visiting a family and how much safeguarding issues there are out there and it did hep many to have that foundation that this is existing and you will come across it in your career and how to approach it….I mean we have a bit of a safe zone because we're in our first year and our mentor is there but I think it's good to go on your first placement and with that foundation and not going in blind and not walk away going "oh my god I actually did not know this exists" or how do you sleep at night? Because otherwise you

	do walk away thinking "did we react properly?" I think to have that sort of base there it does help for sure.
108.	R: I'm thinking about a family that I saw in the ser and they all live in one room and had second baby so we came to see them in their flat and they had the smallest kitchen in the world and it was literally a bed for the oldest child and a cot and also a tiny bathroom with a shower and nothing worried me about their home. It was safe, the doors were locked
109.	B: *nods*
110.	R: there was toys there was stuff, they were incredibly poor and that in tons of support and making sure they were accessing all the right financial support was important but their daughter was scrubbed and dressed and clean and fed and out the door to school as a priority and she had a safe environment to grow up in and you know in contrast seeing a family (the Melser VRLE) where the telly is on during the day and the house isn't safe or you don't really know whose coming through or a very pretty house (the Parvell VRLE) with no toys no child friendly things…yano you can say freestyle parenting but if there's nothing for your child to engage with then you're not parenting, that's neglect and yano I think in terms of that…in terms of informing practice it's kind of you know, what am I looking for? It can be really surprising when you walk into anybody's home and you realise that something's happening or whatever and unpick that but when it comes to a safeguarding concern you're looking for things at slightly different levels of..
111.	B: I agree, I agree, I walked into a family and she had her 6th child and it wasn't the biggest and they didn't have the latest sofa but those children were cared for and they were in the kitchen doing their home work while she breastfed and the toddler was sitting down having a homecooked meal and equally there was family they certainly had a lot of money and she was repeatedly telling me that 9 year old daughter does all the cleaning and cooking and I was thinking "this shouldn't be happening" a 9 year old shouldn't be coming home doing all the cooking and the cleaning but the more she talked it seemed the daughter was doing more of the mom role and it does take time to unpick these things and time to learn as well. *nods*
112.	R: I think one thing that would be really good, I don't know how possible this is but one thing I find that people back away from is culture and people get very concerned and touchy around culture and whether you're allowed to speak into someone's culture or not and I wonder whether if there is the possibility of future VRLE if you throw in a completely different cultural background then it's about picking out what is human right issues in that what are safeguarding, what their partner thinks they should be doing and m thinking about abuse across churches in particular and when it crosses into boundaries of abuse. Because I thought you did the affluent family brilliantly and the impoverished family brilliantly. I thought those were really good they're two real extremes and people tend to assume safeguarding comes with other…that safeguarding doesn't happen to them but I wonder if culture is an are where people can enter that virtual space to challenge it and avoid offence etc. whilst unpicking what is really going on
113.	B: I know we work with a lot of multidisciplinary teams together but you never know how to interact with them though I guess we may find out in the next couple years. It would be good to have a scenario where you literally talk to multidisciplinary teams and you see where it goes. Does that make sense?

114.	Moderator question asked for clarification
115.	B" That's right and to almost see the end goal. Very often of course we start a process here but you never see the overall end goal and it would give you a confidence boost to see that you did really good. You contributed to something really good and it would motivate you to trust your gut instinct, to pick up the phone to your mentor or midwife in charge and I think that would be good experience to look into.
116.	R: I have another suggestion but I don't want to go into it if C you have anything you want to add?
117.	C: I don't think so I know of feel we're very much at the start of the journey and think its like I said I found it really helpful going into placement apart from kind of like some technical things which I think are always kind of like an issue with developing apps and software and things like that, there' nothing else at the moment that jumps out for me.
118.	R: the other thing I thought of..the other thing I liked about the VRLE was that I just wasn't black and white *smiles* and I don't thinks safeguarding is black and white and as we talked about earlier so what my other thought would be is it's almost easier being the first person on the scene so being the first person to notice oh everything isn't ok here whereas when you have a family in the postnatal period and their safeguarding folder on the ward is 2 meters deep and you think "oh my goodness" and then things change and you almost think "do I, don't i?" and it almost adds a another layer of difficulty because you know the problems are there, everyone knows the problems are there and it's like what's next if this child is deemed to go home with mum and dad? It's even more murky really because all the problems are known about and what is your role then?
119.	Moderator: The next one in the pipeline is PPH for your third year.
120.	R: Is that going to be for our emergencies unit? Yes! I'm so happy!
121.	T: something to look forward to then. VRLE are good for things you don't think about like you know a third year reminded us that when we're giving insulin to make sure we use the right syringe and we were like "oh crap" so VRLE could help with this and other things you don't think about.
122.	J: I think those emergencies vrle will be really helpful because one of our practice educators ummm she's worked in high risk maternity care for years and years and that's kind of her place ummm and she was talking the other week about how pre eclampsia drugs is… exactly everything because she's done it so many time but that she couldn't look after a diabetic lady because it's a different skill set…it's that getting to the point where it become second nature so you're doing it quickly without having yeah even three seconds of *panic noises*
123.	B: I agree I don't know if that's on the programme…it's like PROMPT there was a study day there not long ago in the Trust and if you had the virtual thing you could have sat and practiced at home as much as you want. Even if you just practice as an individual when practice team work for emergencies….I'm a practical learner I need to visualise and you want to be able to safe practice.
124.	Y: I found it, like I found it useful but I also found it slightly difficult because the questions were obviously pre-loaded so obviously you don't put in what you would ask so when it asks the question that's not necessarily something that I

	would have asked…so I still don't know how my questions would flow or something like that. Like I now know things that I should ask but I don't know what would happen if I asked what I would naturally ask…if that makes sense.
125.	J: *nods* , it kind of even as well before you even see something so like the child sleeping in the dog bed hadn't even loaded on the screen and it just came up saying "oh you've seen the child and the dog sleeping in the bed together" and I was like "oh where is that" and then I saw it afterwards so it like pre-judges it by when you walk past it even if it doesn't load either so it kind of … I didn't see it and it just kind of came up anyway.
126.	Y: I found mine was almost like the opposite like I saw the baby in the well the toddler in the cage and was pressing like the alarm bell and the gut instinct bell and stuff and nothing was happening because I think I hadn't walked to the right place for it to register for it to register for what I was pressing the alarm bell for so I almost had to walk past it for it to pop up.
127.	J: no I hadn't actually seen those until I turned round in the game to see those then I realized those were there in the drop down menu and the first family thing it was in a drop down menu to click for gut instinct or…
128.	M: I really liked it actually. I found it uh a really good experience. I don't know if I was just being really well um I'm quite new to it really and only played on it the other days and it…I…really enjoyed messing with it to see what would happen if I clicked on the answers that were not what I would say…. I think….I don't even know really it was just so I could…just…see how the technology worked and if it was different to the natural pathways of how it was going to go…you know I was just sort of testing it. *laughs*
129.	T: I thought….I thought it was good…two things that you could see on there was like correct or a red cross would come up…I don't know if anyone else noticed that? and then there was like a few little…I did the other one, not the one with the baby in the cage but the Melser…and I thought the actual content in it was good and it kind of made you think about safeguarding and when to push and when not to push. It was interesting for me because you know paramedics with safeguarding we tend to you know…foot around it a bit sometimes we aren't direct enough whereas in maternity it seems to be that when there is a problem the midwife would say you know "your child was jumping around in front of that heater, why was that happening?" whereas I think we'd be a bit more like "is everything going on ok at home" and you know "what can we help with, do you need any safeguarding referrals" and stuff like that. Rather than being like "what's your kid doing?" which is one of the things that was said in there "what's your kid doing" and it was quite interesting to see in there that if there is a safeguarding concern then you've got to go ahead and deal with it.
130.	J: It's definitely better this one I think, you can kind of more interact with things a bit more. I wonder if instead o having the gut instinct and alarm bell button maybe you have to click on the thing or tap the thing that you are concerned about so that it encourages you to pick up on it and then it could be that maybe you could do that with anything in the room so that you have to think so why is that alarming you so that instead of when you click on it and it tells you why it is a concern. And it could pop up with whether it is a gut instinct or alarm bell and you choose and it makes you think people might pick up on other things like the hundreds of bottles of wine before the child or something or the fact that it was then uncle asleep there with the baby and not the dad. It would just encourage people to think about it a bit more in context.

131.	Y: I agree with T that like in (our healthcare) environment with safeguarding we find it really difficult to bring things up and mention the word safeguarding because were always scared it's gonna cause a reaction but I think this VRLE has really shown me kind of like how to bring it up and to not pansy around it and walk on eggshells and to just bring it up because there might be a valid reason, they might have insight like the dad, the one I did was the consultant and so his reaction to you was telling you more than if you hadn't asked at all so I think that was quite useful.
132.	S: I found it very useful and very interactive and I enjoyed it using it and um I think for me with the it obviously asked the questions before and it's not necessarily what you would say but I think for someone like me it kind of helps for when I am in a situation I struggle with like exactly what I should be asking and how I should be wording and things like how to approach especially subjects such as safeguarding how should I be asking the questions about coming across in a way you wouldn't want it to come across as so I feel like it kind of helped in that sense and in what way can you ask. Because I was like with some of the questions like can you actually say that, can you ask those questions like that? So it kind of helps you kind of yano just that practice element of trial and error like you can pick the wrong question and it doesn't matta, at least you know then yano ok I wouldn't' say that or I would change it or adapt it to say this instead because I know that might be a better way to say it so I feel like it's not the real thing but it's close enough, especially in a situation like safeguarding. It's quite a serious thing you don't wanna be wrong in what you're saying.
133.	J: I thought to was good because it's a different take on learning and you're not sat in front of trying to learn off a power point all the time and it's actually in the environment and learning from clinical practice with something that builds your confidence and I've done a lot of safeguarding during my training and for me I felt a lot more confident in safeguarding environment but it helps you just pick up on those things. Especially like gut instinct there are so many professionals who just have that gut instinct and it gives you that hope that maybe it is something you can learn a little bit in that environment so I did enjoy using it, definitely and I think I quite I think it would be nice if you could select who you would refer them to (this is an option in the melser family VRLE and maybe you could select why you are referring them and maybe those things that you clicked on like say you clicked on police and earlier you clicked on the baby then maybe you could say the baby is the reason you are referring them to the police so you could just take it to that next steps to consider why you are referring to those services. Or what is it that's concerned you in that environment that would mean you need that service specifically. If you could do this in the VRLE because not everyone engages in the classroom setting and gives them an opportunity to explore it for themselves or if they had another question or someone picked up on something else. It does make it more reflective of that person's practice in a sense because if you could click on anything in the room and say that was a concern to you then when you refer them in then it gets you to justify why does that make sense? It does then reflect your practice because someone might have felt it was a really dirty environment and wanted to refer them for that and if they clicked why it would need feedback as to why this is ok or maybe to refer for a different reason. Or you know link it to the hoarding policy to give them further learning around that. I'm trying to word it right, but…. *laughs*
134.	T: I think similar to J really. My thing would be that I quite like it that if you get half way through the scenario you then get a pop up where you stop the session and you get your immediate feedback and be like a little question like –

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	so far, who are you referring these to? – and then you could have…you could go through and tick off all the services you want to refer them to and you get feedback then about what is right and prompts for things that should also be considered. And then you could go back to the scenario and carry on and pick up other things. It would be nice to know half way through that you're on the right lines or that you're missing the point there. Overall I liked that we could see something different especially that we…I'm sure B would agree that ours is just powerpoint, powerpoint, powerpoint all of the time whereas this was nice to do something different, to have a different way of learning to do something in a different way. It was nice for me to be able to do something different.
135.	M: Just to add on to what T was saying, I'm a practical learner, I don't I h I find it really difficult to focus and absorb things from a powerpoint so being able to ahhh practically learn those skills in the VRLE was ahhh it was really beneficial to me I think because I learnt ahh what I need to be doing in practice rather than all of the information behind it. I know it is important to know all of that and I know and I do learning in my own way all of those things as well but the VRLE sort of solidified it and I was able to sort of put it all into practice and as I said earlier like messing around with it so I can see what is wrong and what is right and just sort of so *laughs*
136.	Y: I think it was good to rather than…like others are saying…rather than just sitting in front of a pwerpoint and learning the theory it was good to be able to apply some theory that you might of done but also to be learning about theory in a practical environment and having it like a computer game I really liked and but I think that think for me I know of found it was like you went tin the house and you did everything and then they were like of now it's time for you to leave and outside the house and that's it and obviously if that was a real environment then you wouldn't just leave the house and that would be it like you would have the paper work or something. So I think like J and T were saying having that bit where you could click who and why of referrals I think would be beneficial because then you would have a bit more in your head for when you are actually in that situation.
137.	J: it wasn't obvious how I was supposed to leave, I sort of wandered round before I went back outside. *nods* is there somewhere in the VRLE where you could diarize your specific findings before coming back into the classroom to discuss it? Especially if you're using it at home and not coming back in to the classroom environment you might pick up on something different
138.	S: I was gonna say that I liked using it because it was different and like everyone kind of said it wasn't just like using a powerpoint and I don't mind using a powerpoint and learning from it because I feel it kind of gave the basics so when we did go into learning through the VRLE you already have some kind of understanding of you know your gut instincts and what you would do in those situations and it gives you that practice before you go back out into practice and just to kind of learn from it and I think that having a personal summary of how you've done is good but I also feel that sometimes it can be beneficial for others to be able to discuss it with other people just in case there are things that they picked up on that you didn't pick up on just so that you know you're not missing out on things and they could say you know I picked up on this because I thought yano this caused me to feel like this and you could be thinking well I didn't find that as alarming as you did but I get where you're coming from so it just allows you to discuss it and think you know if I go thorough it again maybe I'll notice that or I'll look out for that to see if it causes me to feel any alarm knowing now why it caused you so much alarm. I don't know I just feel it might be beneficial

139.	Y: I think like ummmm I don't know if T will agree but we don't get much teaching around safeguarding in Uni so anything we learning is just in placement which for me can be a little bit lacking depending on how your mentor is because you only learn how your mentor is doing it because we only have one mentor per year and that may not always be how you want to do it or how you think it should be done. So I think for the me VRLE especially for when I qualify and next year when I have a bit more autonomy about what I can do for example in a patient's house rather than just letting a mentor do it I think I'll be a bit more direct but at the same time I'll also now know a bit more about how to word things because I can be like a bit blunt and no really word thing very well and so I think for me the wording like S was saying the wording in the VRLE is going to have helped…I can't even speak now but…looking at how it was worded in the VRLE is going to help when I am in an actual environment
140.	T: Yeah I think I haven't actually thought about it until you just said B but we haven't actually had much have we? We haven't had any safeguarding training but yet that might be that we have that in the third year but that should be something we have in our first year really.
141.	Y: And like I think it would be useful to go over like the paperwork in the classroom because you might miss things like how to put it down on paperwork and like I'm slightly older and T is slightly older and she's a mom so our gut instinct might be a bit more developed that some 18 year olds on the course so I think it would be really something that a lot of people would find beneficial.
142.	J: I definitely think it depends on your level of experience, say we get a lot of safeguarding training throughout our midwifery programme and I have spent three years clinically placed with a midwifery safeguarding team I feel really confident in caring for women with safeguarding issues but I also think that for me it is useful to revisit that and be on my own in that environment and make those decisions myself but I think if I having a lot more experience the VRLE is maybe not as beneficial as it might be for someone with less experience because I am exposed to it literally day in day. But it is useful to be on your own in the VRLE environment and to have to make those decisions on your own…is a completely different experience then from when you're out with a mentor so from that aspect the decision making is really good.
143.	M: Like J I worked with a safeguarding midwife for the whole of my first year and it was really eye opening firstly how she dealt with it because she was just so confident and she got them to talk about really sensitive issues even with me there someone they'd never met. They were always so open with her, sometimes a little confidential but that's to be expected when you're broaching something so sensitive m but I think using the app now I'm not working with a safeguarding midwife it has kind made me analyse how I was in those situations and whether I reacted in the right way if I outwardly showed my disgust in some situations but I don't think I did or my mentor would have pulled me up on it *laughs* but it's definitely helped me to think back on some of the situations I was in before and how going forward I would adapt my own practice to sort of to sort of look at everything as a whole rather than just going in and looking at the pregnant lady and knowing there is a lot going on but I didn't deal with a lot of it because my mentor was.
144.	S: I think for me, when I have been in practice I haven't come across many safeguarding case so I think it's been…using the virtual even though it's not real and it's not how it's going to go but because I haven't seen much and been in practice and I just feel at this point that's why it's been helpful to me and I

	don't feel I would be at all confident without the VRLE to approach any safeguarding in real practice because I don't feel like I've seen my mentor deal with it a lot yet and I don't feel like I've seen as much as I would yano, I just don't think I've got the confidence or the experience yet. But I feel like that's why using the VRLE just gave me something just so I am a little bit more prepared and I don't go into a situation where I am completely stunned by it and I'll instead know that this is causing me to feel a bit alarmed and I can sense something's not right here and then be able to say to my mentor you know, I noticed this, to see if it's just me picking up on things or if she's seen it as well which I think you know useful because being in first year I don't have that experience yet as much as others and it's just…
145.	Y: I think it also highlights because you know you're ticking who you want to indicate what safeguarding for and it's not just for abuse and it highlights all that safeguarding is for and then when bringing up the conversation of safeguarding with familes makes it easier because it's not just saying I think you're causing risk to your child it might be instead that I think you might need a bit of help in this category and it nicer for the taboo subject and it's like then I'm not saying safeguarding is something wrong but just that you might need some help.
146.	T: I was trying to think of a time when I have been in practice and I have been having safeguarding concerns and it's like completely different to midwifery but we we went ot a house where we couldn't get in the front door because there was so much stuff and we had to take our bag off because we couldn't get it through the door because there was just so much stuff and like the police came after and had to take their jackets off to get round the house because there was that much stuff and I was trying to think about how we approached it because unfortunately her , her, husband had died and we couldn't find him…which was great…and then when we did then had to sort her out and think about how was she gonna live in this environment after and safeguard her and I was trying to think about how we approached it and I think actually all we said was were gonna put a referral in because it's not suitable for you to be living at home like this is that ok and she said that's fien but we never actually directly said why do you live like this, how long have you lived like this for, it was like forbidden forest in harry potter the amount fo cobwebs there were and how you could live in that environment…it was crazy but we didn't actual talk about or approach it which just goes to show how much we do step back but what I've learned from the VRLE is that actually you can ask those awkward questions and actually they're not awkward and they are there for safety, for a reason, so you should have the confidence to actually approach it and I think now if I actually went to something which is similar where I do have a clinical concern and where I think safeguarding concern I'd like to think that I now do have the knowledge to say why do you live like this, what is going on, what else is going on for you to live like this?
147.	J: I think it's interesting that we're all saying we feel quite confident at picking up the safeguarding concerns but actually the issue for a lot of us is how we word the questions, how ask the questions and how we actually communicate with people and obviously like I said when I looked at it before was that one of the things it would be nice if you could input the way you would ask the question yourself for checking. That's what concerns us most is how to word the questions. It would be good to have different virtual environments like I had to go look after a woman in a tent or even women that wouldn't let us through the door and threatening violence on us and it would be good to know how to deal with situations like that and safeguarding yourself? In that scenario with the dad where he did seem quite confrontational one of the choice was that I'm not going to ask because I don't feel safe and I want to leave so a bit more of that would be helpful...

148.	S: I was just gonna say that I think it helped with my gut instinct know that what cause alarm for me like personally and not just because obviously something I notice might not be the same as someone else and obviously if I wasn't able to click on it as long as I just saw it there it just helped with that kind of you know of that's concerned me and helping with my gut I think….
149.	J: I liked in the way in the first family that as you walked past the kitchen you could kind of see into it so it wasn't sort of an obvious m thing but there was other issues hidden in the room whereas for the second one all the doors were kind of shut but just kind of like I guess something just to detract you form the situation, maybe they're hiding things in one of the rooms because people can be very deceiving and kind of making you think out of the original info but it makes it more fun and I quite liked that
150.	S: I agree with that when you see certain things it really helps with you know things about that whole idea of thinking and questioning and having doubts and concerns and that's what you need to be doing in a real life situation and thinking why does she seem quite agitated by that or you know what is she hiding? I think it's good having those questions and doubts otherwise you'll leave wishing you had asked her in case you are causing their safety to be compromised and the VRLE puts you in a situation where you are not rushed and you have time to think about it and it's good to just take a minute to think and not feel rushed.
151.	Y: In the one I visited I wanted to open the cupboards a bit more and explore around the house because when I go into patient's houses one the pretense of getting their tablets or whatever you know of have snoop around and see what else is again on in the house are they just living out one room and that so to be able to have a look around the house especially when you've got gut instincts that there's something wrong anyway you base quite a lot on the rest of the house as well
152.	T: there was one thing I completely forgot to say that there was one point in the one I visited where at one point you get blocked in a corner and that's one thing we're taught as paramedic to never get blocked into a corner and I'm guess that was int here in purpose to make you think about that, I really liked that bit so that was good because even though it was a virtual, it just didn't feel right and I was thinking oh I shouldn't be stood here that was good!
153.	Hi: I would have liked more of it teaching me how to do things, a little bit more of that would be most helpful. That's what I found it most helpful for. so you sometimes if a parent or anyone mom or dad says something to you and you know what they have said isn't right or that you need to intervene and you don't know how to approach it you know "I don't want to offend you but I do need to be honest with you" so examples of how to give that information and a little bit more of that I n there would be nice. A little bit more of "if this happened this is how you can approach it" , I find that really helpful. I think it's more helpful because we weren't in practice but I think even if we were in practice there are issues that don't come up very often I mean it's not very often in hospital that you see somebody that you need to correct their behaviours like the safe sleeping. You explain it but you don't often have to correct it because you don't see it very often so when you do it can be difficult to know how best to approach it so when you have that example of how she (the clinician) approached it in the VRLE I think that was really helpful. So I think either way it's quite good for that.
154.	S: I've heard quite a lot of times…that patients from neurological wards or strokes wards or brain injury wards that they feel as if as soon as they've had their like first bought of rehabs they're sort of just dumped by themselves, they're left by themselves and the rehab stops. Ummm so I think VR has a really big place, especially for neuro patients so they can have repetition in the rehabilitation so it keeps going on and for MSK outpatient therapy as well VR would be really beneficial

155.	A: Ermmmm it wouldn't let me assess the baby. I'm gonna go back in later and try and do it but the baby was on the table and I couldn't…I had to chat to the other girls to find out what happened because it wouldn't let me progress any further than that.
156.	Ja: I was going to say that on the app that when the uncle had first woken up the dad had come home and the mm was sat down with the baby and you were the only person left standing up so it was quite like a daunting experience. If that was real life and I was on my own I would find it quite scary. It makes you feel quite secluded and like the odd one out. It was quite intimidating.
157.	P: I was quite shocked when I first walked in and I saw baby Evie was sleeping with some random man on the couch. I think that's the thing that's good about virtual reality because if that was my first experience and it actually happened in real life I think I'd have to like just take a moment because it's quite shocking but like the way that they baby was left to sleep was what got me first
158.	M: We couldn't really have a conversation with the mother because she might have to say something private and there were two men in the house
159.	Jo: I thought that the parents might have given Evie alcohol to get her to go to sleep because they were saying how much she was crying the night before.
160.	Cu: ummmm I think that the app didn't really work that well for the learning in the sense that it was really slow and it kind of didn't engage me that much. That's what I found anyway.
161.	D and X speak at same time.
162.	X: oh sorry, you go D.
163.	D: I was just gonna say that on the phone it was hard to navigate round and I kept walking into walls where it's so tiny so if there was an option where we could click on it and make it bigger that might work. I can't use it on my laptop because I have something like Microsoft 10S or something and it's not compatible with it. It's new but it doesn't accept chrome or anything, so I have to use my old laptop to do all the meetings
164.	P: I agree with what A was saying it worked a lot better now we're using it in our own homes and the whole story line flowed and if you look away from the graphics not being amazing then the actual learning that you can pick up like the gut feeling and the alarm bell one was very helpful because it sort of made you look for things rather than just sort of work though it or wait till you get to the end.
165.	A: It was good I suppose the only thing was the limitations of the scenarios because it was actually practice but it was very useful. Maybe if the patient had different reaction the answers you gave them it would make it a bit more changeable shall we say more like real life essentially….
166.	G: I think it depends on how you interpret it and how you would deal with it in a real life situation if that makes sense. So you don't get that real feeling that …you know…that conversation you're having because you might interpret it as passive or aggressive or whatever..
167.	X: I think that like you know obviously it's virtual reality so it's quite structured so you had to do one task followed by another I would have liked the option of different activities instead of just having to make the tea or whatever. I dunno what I'm trying to say *laughs*
168.	G: I think for me first of all we were asked to go into that home and have a look around, but we weren't then asked to report on anything that we saw that might be a safeguarding issue and it would be good to have feedback in real time because when enquiring about Evie's eyes and the marks on her body and seeing the response it encouraged, this raised alarm bells for me.

169.	K: well this isn't anything to do with the content wise but in terms of virtual reality I actually get quite motion sick with like anything like that so I found it quite difficult actually to fully immerse myself in it without kind of feeling a bit off.
170.	Moderator question for clarification of device(s) used.
171.	K: Literally just kinda like using it on my laptop… but otherwise I think it's a great concept.
172.	X: I didn't have enough storage on my mobile even with removing a load of apps so couldn't experience the VR headset and did find that it drained my laptop battery
173.	Ph: I just think it may present a threat to our…not a threat but like um it doesn't really allow us to demonstrate our interpersonal relationship with the patient like how could we possibly demonstrate a great deal of compassion and empathy through a virtual reality environment if you see what I'm saying?
174.	Hi: I think you can get the wrong end of the stick through typed words. You have to hear the tone of the person's voice to e able to I think understand and what happens then if it's somebody with visual impairment that or you know m or I don't know *laughs*
175.	O: I think overall we don't have the resources to practice these skills as much as we'd like to so I think that the idea of having virtual reality where you could just practice and practice where you don't have the resources or an actual person is a good idea. As opposed to the having of conversations I mean that Hi was talking about, this practising of skills is a different training.
176.	Ky: If you doing VR as a practice learning tool just going on what O said if we was going to practice suctioning or nuero patients, could you use the outcome measures to kind of guide your practice? For example the better balance scale in a physio way like doing it through VR way just as an example.
177.	Ph: for me the hardest thing I found was how to open the front door once I worked out how to ring the door bell and walk to the right place it was fine. It was really good to walk in and observe what was going on in the house, a really good experience.
178.	J: I done it but to get the most out of it I think you need to discuss it like in a group. On it's own it's helpful in a sense but it's not…it needs group work as well to discuss because with safeguarding for example I might see something that someone else doesn't and I think it needs a bit of discussion as well
179.	Cu: I think it would be really good especially for 1st years and relating it to paramedic science because you could have a client sat in the middle of the room and you could be discussing what you would say to them and how to say it. It would definitely work in that environment.
180.	J: I think that it just gives the response that you guys put it and doesn't give a chance to discuss and safeguarding is a lot about discussing how you would manage things rather than just a black or white answer.
181.	Ph: From the start of getting in the house and having a look around you do kind of feel that you are in that environment. Like the only problem I found was how to get on to the next stage of the programme. for example putting the kettle on or whatever else that was a bit kind of confusing but other than that…but really good to wander round the house and engage with the family who weren't really engaging and you can see that from a safeguarding point of view as well compared to when we're on the road. And people do act exactly the same and sometimes it is health professionals who you need to put safeguarding in against and there's been experiences in the past where that's happened .
182.	Ba: Anyone find it clunky moving wise? I found it quite… it hung quite a lot so it didn't…move as the demo.
183.	M: I found that! I've got a MacBook Pro and I found that when I ran the application it was using all the computer resources, the ram or something and it did become very clunky.

184.	**I**: I just had a play on it and I found it very black and white because it's a computer game making decisions and I made decisions and it told me no I'm wrong and I would still make the same decision. Like getting offered a cup of tea. I don't drink tea or coffee or milk but if I get offered a cup I sometimes take it because it can be offensive to some people to not to, especially in certain cultures that I've experienced but there's no option for that, do you know what I mean? So that's a black and white answer. I'm sure there's a lot of scope to broaden every answer (in the VRLE) but I was just giving an example. It's a great start and something to really build on there.
185.	**C**: it allows us to have an insight into their fridge cupboards and so on. It's a good tool and can be extended into our practice. It can build confidence.
186.	**J:** I think you do still learn things from it anyway because it's more exposure to a safeguarding concern, so I still felt like I gained something from it. Learning something new as in what I would do manage that…no. To be fair I have had a lot of safeguarding jobs on the road so I have got quite a lot of practical experience in it so I don't know whether that does influence it.
187.	**P**: Just one last things. I think as paramedics to be fair we do get stuck on the patient in the house and don't really tend to take a great insight on the surroundings that we're in m we're all quite blinded when we do go into the patients house and we do just kind of focus, don't really take a great insight into what's probably going on in the house so I think we probably miss quite a bit, with that virtual tool I think it will definitely help with the paramedics
188.	**E**: I wasn't able to explore the Parvell house without interaction with Natalie, a few things got brought up in the feedback session which I had missed due to following the instructions. I was also unable to use the alarm bells at the relevant parts, I.e I clicked alarm bells for the bottles but it came up with the bruising information.
189.	**F**: I felt I learned from the real-life scenarios and would find this easier to remember in practice.
190.	**N**: I think it is a good way of demonstrating what it is like to be in someone else's shoes.
191.	**L**: think the VRLE is a great idea, my only concern is that every trust in practice has different paperwork / updates from the next and so if paperwork could be included so we could familiarise ourselves with the paperwork that would be good.
192.	**E**: There are a lot of features and a lot of downloads which can take up a lot of space on a laptop/smart phone if someone doesn't have this. It also assumes people have Internet connections and this again may not always be of access or available to every person.
193.	Emailed contributions from RPs who were not able to attend any of the focus groups
194.	**RC:** I was honestly dreading our safeguarding teaching because it's a tough subject but also because it's often taught in a very black and white way which doesn't translate easily to practice especially in a time of underfunded social care. Anyway, the VRLE completely threw me as it was so different to my expectations and really helpful! I think the VRLE is really creative. I guess it probably has mixed reviews but honestly I think safeguarding is hideous to be creative with so well done you! I found that the VRLE was really helpful for seeing the wider family picture. It's hard to describe that in a scenario! I also believe that the feedback from the VRLE was helpful. Making good decisions and mistakes on there, meant that if we made a mistake that was a bit obvious, no one else saw. Also, if we made a good judgement call, the feedback might include something we hadn't factored in e.g. oh yeah, I'm the

	only adult witnessing this! I'm responsible right now! I think this leads to better judgement calls. I think that following up the VRLE with a challenge to work out what to do next was really good and I'm glad you highlighted the different opinions of the clinical staff about the ambulance for the 14 day old baby. This helps to show that safeguarding is VERY subjective and that we have to do the best we can with the information available. In placement I have found it really helpful when staff have said "There's not a right answer" because they're all human trying to do their best and making judgement calls based on what information they have at the time.
195.	E: I really enjoyed that the vrle wasn't black and white, there was a lot about perception and probing and keeping yourself as safe as possible when weighing up who needs what. This is MUCH more close to real life than simple instructions as to what to do next. It was interesting and engaging way of learning such an important topic. It has helped me to 'bridge the gap' (between academic and clinical placement blocks) and taught me to trust in my gut instinct alongside more about referrals. Technology is a pain when it's slow but it didn't stop me learning today.
196.	AS: Upon arrival into the Parvell household, there were several issues that rang alarm bells, as well as gut instincts. First of all when Natalie Parvell answered the door you could see there were apparent bruises to her face and arms. Secondly there was a child asleep in a cage with a dog!! Alcohol and dirty bottles scattered about the kitchen, their daughter (Evie) was asleep on her uncle, who could of still been intoxicated from the night before. Natalie was very concerned about the house being tidy before her husband returned from work, when he did return he told her that he had invited friends home and expected her to cook a 3 course meal! He was extremely standoffish and my gut instinct told me he was trying to use his medical job to cloud our inspection of the baby. When I carried out my health check, you could see obvious bruises to Evie, however the husband dismissed these as Mongolian blue spots, this rang alarm bells because what if he was trying to use his medical knowledge to hide abuse. I would have to refer to the notes to check if any blue spots were recorded at birth. I also noticed that the whites of her eyes were red, I asked the parents id this redness was new, and he immediately spoke up and said that this was due to birth, however he also said not to bother checking the notes as he'd just told me, this rang alarm bells because what if this was also a cover up for abuse, I would still go and check the notes to make sure! I really enjoyed using VRLE as a way to continue to learn about safeguarding – it helps to be putting ourselves within that situation.
	Q4 pre-action - Do you think that Virtual Reality Learning Environments (VRLE) can help you to learn something new?
197.	Not sure, I have no knowledge of it
198.	Rather than learning stuff from VRLE, I think it will be useful to practice and reinforce things learnt in theory
199.	I have no idea as I have no previous experience of VR.
200.	Unsure as have no prior knowledge of VRLE

201.	have the chance to see and use real life scenarios without the risks of being in the real life situation.
202.	I am not sure yet
203.	I do think that it is a good way to learn however sometimes it can be easy to move on from it quickly and not completely develop your knowledge and understanding of each topic to completely gain correct knowledge
204.	Hopefully - I've never used it before
205.	Im skeptical
206.	Yes in certain learning environments and circumstances
207.	I'm unsure as I've had no experience with VRLE
208.	Have no idea yet, hopefully so.
209.	Don't really know
210.	If they're relevant and done well.
211.	not sure as have never used it before.
212.	Yes but not if they ruin hardware
213.	Not sure, need to give it another go. Was too busy in level 4
214.	Because its something new.
215.	It depends on the learning environment and the target audience
	Q5 pre-action - How do you rate your current level of confidence in clinical skills for safeguarding before using the Virtual Reality Learning Environments (VRLE)?
216.	Feel confident using it but haven't used any for clinical skills yet
217.	Never used
218.	don't have experience with virtual reality technology
219.	I don't understand the question??
220.	unfamiliar
	Q6 pre-action - Please rate your belief that Virtual Reality Learning Environments (VRLE) can help improve confidence in clinical practice
221.	Unsure Yet Until I Have Tried, But Would Expect It Will
222.	This will help alongside other resources
223.	Difficult to comment as not used VRLE
224.	If it is a scenario that the student has very little experience of in practice, it could be helpful prior to gaining more practice experience
225.	unsure as haven't experienced it yet

	Q7 pre-action - Please rate your belief that use of Virtual Reality Learning Environments (VRLE) can help bridge the gap between theory / practice
226.	unsure as haven't experienced it yet and do not know what it is.
227.	In theory this could significantly benefit students if a good system is used
	Q8 pre-action - Please rate your belief that use of Virtual Reality Learning Environments (VRLE) for practising clinical skills will help you with learning to use intuitive practice (using your gut instinct).
228.	unsure as haven't experienced it yet and do not know what it is.
229.	It depends on the siutation [sic] of the environment.
	Q9 pre-action Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an impact on humanisation (the 6Cs: Care, Compassion, Competence, Communication, Courage, Commitment) of your healthcare skills.
230.	Not sure as yet
231.	Will wait and see
232.	Unsure (x 4 responses)
233.	I have no idea
234.	It appears fairly stilted and artificial. Misses a lot of the more subtle nuances such as body language, tone of voice found with real people. Actually being with real people in real situations develops care, compassion and communication.
235.	no idea
236.	unsure as haven't experienced it yet and do not know what it is.
237.	I would say its difficult to humanise care in a virtual environment so i'm not sure if this will have a positive or negative impact.
238.	I am unsure how well it would impact this
239.	Not sure really other than through the discussion with others. I feel much of the 'humanisation' can only really come with practice, not all theory or virtual
240.	Not sure. Not a negative comment, I just prefer to learn in a real classroom or in practice. I don't engage as well with IT. Feels impersonal
241.	im unsure what the impact will be
	Q10 pre-action Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an impact with your learning?
242.	Again not sure
243.	Limited impact, I prefer to learn within real situations with real people
244.	dont know
245.	unsure as haven't experienced it yet and do not know what it is.
246.	not experienced it so unsure if it will help me.
247.	some positive but gaining access to virtual reality can be time consuming and having access to download the softwear [sic] is not always available

	Q11 pre-action Please rate your belief that use of Virtual Reality Learning Environments (VRLE) will have an associated impact on patient safety?
248.	No knowledge of software, unable to give opinions
249.	This is because each situation is different and can result in a different consequence so it's important to take this into consideration to ensure patient safety
250.	Unsure (x 3 responses)
251.	Unsure of the confidentiality and whats it like to use VRLE
252.	I do not know (x 2 responses)
253.	unsure as haven't experienced it yet and do not know what it is.
254.	Not sure yet. Don't feel like I've had enough experience with it
255.	Again some impact but this depends on the patient comorbidities.
256.	Q13 pre-action Would you like to tell the researcher anything else?
257.	I have no experience with this, but am optimistic that it will help my learning
258.	I'm excited to try it out as it is a new way of learning for me
259.	It is a different and enjoyable way to learn.
260.	All answers are dependent on the quality of the VRLE and how closely it portrays real life situations
261.	I dont think VRLE should take over lectures and lessons to support our knowledge and especially skills, I feel the VRLE will support confidence with technology and keeping up to date but if not used carefully can really spoil some learning opportunities.
262.	I believe that VRLE will be really good practise, and I believe that with enough scenarios based on real life, it will help and have a positive impact on confidence
263.	I think it is a good way of demonstrating what its like to be in somebody elses shoes.
264.	the headset causes nausea, but really engaging and a really interactive way to almost put knowledge in to practice
265.	I have no educational experience in this field so I found it difficult to answer with a strong judgement of VRLE
266.	The questions are a bit hard to answer due to no prior knowledge of vrle
267.	virtual learning is new for me and therefore answers were given on a suspected outcome
268.	Keen to give it a go
269.	Very useful learning resource.
270.	I'd probably use it less as i've had a lot of experience with safeguarding and feel relatively confident. I've taken several disclosures and referred and acted appropriately and feel confident in doing so. But i think safeguarding is something that is individual to that person and so if their is a variety of situations to explore it will be a really good tool. As every women is different and her story will never be the same to the next safeguarding concern you participate with.

271.	I think VRLE is a great idea, my only concern is that every trust in practice has different paperwork/ updates from the next and so if paperwork could be included so we could familiarise ourselves with the paperwork would be good
272.	I found use of VRLE at Level 4 very useful as it allowed me to be more direct and push for more information than I would feel comfortable in usually - this really helped to show me what is acceptable in the professional role that I am looking to go in to. I hope that this further use of VRLE will build on the confidence that I gained at Level 4.
273.	The VRLE is a really useful learning tool that I hope is continuously used throughout the duration of our course.
274.	I really think this a fab idea! Something health education is really missing
275.	May use it more as i get used to it more.
276.	There needs to be a way that it does not put a massive strain on the hardware used to access it as this is off putting
277.	The only difficulty I have experienced with the app is when there was a lot of us all using it at the same time in a lecture and the programme seems to lag.
278.	There are alot of features and a lot of downloads which can take up alot of space on a laptop/ smart phone if someone doesn't have this. It also assumes people have internet connections and this again may not always be of access or available to every person
279.	The benefits of VRLE use could be great however they are only as good as the software. If it doesn't work effectively - as it appears not to, then very little (if anything at all) is gained from it
	Q2 post action - Would you like to use more Virtual Reality Learning Environments (VRLE) for learning / practicing clinical skills?
280.	I feel for some sessions the use of VRLE would be more relevant than others, for example practice of clinical skills such as urinalysis rather than skills such a gut instincts which can only be fully experienced in real life.
281.	For other topics/units also, but I am not too sure it was that helpful, found it more a waste of time in the classroom. But better for others that may need visual help.
282.	It is very helpful when using at home as it isn't as slow, in the classroom it didn't work very well
283.	I did enjoy it however I do prefer to use it at home rather than the classroom.
284.	i think they have there place but practical learning and discussion required alongside
285.	I do find it useful to a degree but dont find it easy to use as someone who doesn't work well with computers!
286.	I think sometimes this will be good but not always.
287.	I would but not all of the time
288.	i think they have there place but practical learning and discussion required alongside
289.	I do find it useful to a degree but dont find it easy to use as someone who doesn't work well with computers!
290.	Yes if it was better and more sustainable.
291.	I would like to but if Fieldscapes could be used on mifrosoft 10s it would be easier for me as I could then use on my laptop. It's difficult to navigate on a small iPhone screen
292.	I think the platform should be more user friendly, it's difficult on a tiny little phone screen to navigate but then doesn't seem to work 100% correctly on my laptop either?

293.	Q3 post action Did the Virtual Reality Learning Environments (VRLE) for safeguarding help you to learn something new?
294.	It was really laggy and didnt work massively well but was funny
295.	Not as much as if we were to go through power points or have a go at some activities around the unit.
296.	It was helpful to be able to see how to engage with the family and address issues without causing offence - however, on my mobile a lot of the questions that I was asked were physically overlapping on the screen so I could not see them which obviously limited my learning. I also am unable to access the VRLE on my laptop - my dashboard is empty
297.	Although it did not make me learn anything new, it did make it seem more real.
298.	I don't think it was new things that I learned but it definitely made me view it differently
299.	Not necessarily new but definitely reinforced some knowledge
300.	It reinforces and revises learning from practice so it would be useful as update training alongside core skills
301.	Q4 post action What is your current level of confidence in clinical skills for safeguarding after experiencing the Virtual Reality Learning Environment (VRLE)?
302.	I have worked previously in a nursery for 2 years, so this part of the unit I do have a better understanding in.
303.	My level of confidence has not changed since this session as I found it was ineffective to my learning
304.	Q5 post action Please rate your belief that Virtual Reality Learning Environments (VRLE) can help improve confidence in clinical practice
305.	They are good but quite glitchy
306.	I think they can, but there needs to be more information available within the VRLE, like what each referral is for etc, that would be more helpful. Also maybe hints and tips.
307.	Q 6 post action– no open text provided
308.	Q7 Please rate your belief that use of Virtual Reality Learning Environments (VRLE) for practicing clinical skills helped you with learning to use intuitive practice (using your gut instinct).
309.	I did already use gut instinct in practice in regards so safeguarding concerns
310.	Although I understand the concept of the VRLE, I struggle to link it with real life situations and it is also very unclear to see stuff, like bruising, red eyes etc. unless you are told about it.
311.	Q8 post action Please rate your belief that use of Virtual Reality Learning Environments (VRLE) had an impact on humanisation (the 6 Cs) of your healthcare skills.
312.	I think it can help some of them
313.	Can have both negative and positive
314.	Q 9 post action– no open text provided
315.	Q 10 post action– no open text provided
316.	Q 11 post action– no open text provided

317.	Q 12 post action– How long on average did you use the VRLE each time
318.	Drains battery of phone very fast and makes it very hot
319.	It drained my battery something crazy dude
320.	Phone got far too hot to continue using it for a longer period
321.	Made me feel a little bit sick if i did it too much
322.	I explored around the house and had a look around as well as talking to the people in the house
323.	Quite a quick scenario with not a huge variety of options so didn't take long.
324.	Two sessions neither of which I could access or use at the time, become very upset that this has happened twice now
325.	Q13 post action What device(s) did you use for your VRLE experience?
326.	It took a long time to download on my computer, the app is easier but uses so much battery
327.	Q14 post action Would you like to tell the researcher anything else?
328.	Using my phone, some of the text overlapped which was difficult to read so i found myself missing important text. Also very slow, and hard to use on a phone.
329.	Good idea
330.	I found it quite difficult to navigate as all avatars were in the same space, so it was crowded and because of this I couldn't get past the front door and really experience the VR.
331.	I think there are some glitches in the system, which need attention. Some of the text in the boxes overlapped so I was unable to read all of the bulleted options, and also I had to exit and go back into it because it froze and I was unable to continue which was frustrating.
332.	Really useful. Gave me a better understanding of how to handle safeguarding issues in practice
333.	Very slow, lags and not fully explained
334.	Perhaps improve it when multiple people are using at once. Seemed to go down when a lot of people were on.
335.	Felt this is a really good way to teach as it kept me engaged in theory and practice
336.	Battery life o phone went down very quickly
337.	Disappointed the programme doesn't work with Microsoft windows 10s. When using the app on my phone; when given multiple choice options of what to say/what my concerns are the writing overlaps so I can't read the text options and don't know what I'm choosing. We have spoken to developer Nash about this.
338.	Navigating on the phone wasn't the easiest
339.	It was a new interesting way of learning.
340.	The software did drain the battery quite a lot on the computer so would not want to do a more in-depth scenario in the classroom setting. I thought that it was really helpful to go through this as I was reluctant to ask further questions but felt like the scenario guided me through to ask more and it was a safe

	environment to do it in. It also helped to confirm that we should not make snap judgements as things may not always be as they first appear.
341.	It was fun.
342.	I liked the feedback during the VRLE as it helped give pointers where I went wrong or that I had made the right decision.
343.	Trying to download took hours as my devices and antivirus kept throwing it out and not allowing. Halfway through experience each time used it I kept getting put back to beginning very frustrating. Always in the same place
344.	Some things I said I don't feel I would say in real life - for example saying I've noticed its cluttered or the cannabis plants on the floor. Knowing the woman could get violent I wouldn't feel safe saying some things
345.	when first installing VRLE, anti-virus software kept seeing the program as a threat and kept quarantining fieldscape. Has to reinstall it about 4 times. On the fieldscape tutorial instructions were not always clear or how to achieve something. For example 'jump on the white hoop' but no instructions on what keys allowed you to jump onto the hoop
346.	I feel i was more abrupt with the questions and may not have asked them if i was physically there in person
347.	Really enjoyed this session and was very helpful to have the VRLE. Very much suits my style of learning.
348.	It was first timer using VRLE and before I was a bit sceptical and did not think it would teach be anything or be useful however, it taught me to not be afraid to ask questions as long as they are still professional after all we have a duty to safeguard
349.	I found it helpful to just be able to see more of the situation. Normally safeguarding situations are described or written. It's much easier to observe interactions between people or watch how they interact with their environment and how it changes when others come in. This was enhanced using the VRLE
350.	I did enjoy it but wouldn't want to use it all the time in learning
351.	I really enjoyed using the VLE
352.	Found it really useful and made me think about what I would do in safeguarding situations
353.	It was unclear what to wait for next, I would read the text and advice then not know what to do next, each text should lead on to the next direction
354.	I personally think that the current form of VRLE and topics addressed within it at this time would be most effective for a first year student midwife before they have gone out on placement and experienced being in women's homes, to help them to gain experience in what to look out for and the give an insight. However for our current level of practice I felt it didn't increased my knowledge
355.	I felt I learned from the real life scenarios and would find this easier to remember in practice
356.	Although there were a few gliches I can really see the benefit of using VRLE to enhance learning. It was good to experience a potential situation and made me think about how to say things when put in a confrontational situation. I didn't have enough storage on my mobile even with removing a load of apps so couldn't experience the VRheadset and did find that it drained my laptop battery.
357.	Really enjoyed this method of learning!
358.	The VRLE is a fun way to learn but felt I would have learnt more through other interactive methods or powerpoint. I didn't feel that the VRLE taught me more than photos and class discussion would have, which would have given more time for going through other things

359.	I needed a few breaks during the headset use, as it made me feel a little sick (reminiscent of travel sickness,) but I enjoyed the overall experience. A few teething issued such as links being hard to click on and some issues in the VR environment being unable to be selected, but overall very happy
360.	I enjoyed using the VRLE however I feel technological improvements in it's appearance may make the experience more enjoyable.
361.	I wasn't able to explore the Parvell house without interaction with Natalie, a few things got brought up in the feedback session which I had missed due to following the instructions. I was also unable to use the alarm bells at the relevant parts, I.e I clicked alarm bells for the bottles but it came up with the bruising information.
362.	Found when alerted the alarm bell the dialogue box was blurry and unreadable, therefore leaving a poorer experience when using the VRLE. Also, if you did click the alram bell/ gut instinct it didn't necessarily relate to the issue I had pressed it for. Also, in the Parvel VRLE it asked for example if we would accept a cup of tea, and the options to choose from were, I felt, both irrelevant to my reasoning. Some of the maneuvering [sic] was clunky and the 'uncle' had half his legs stuck in the sofa - I concede that it is early days for these learning envirnments [sic]
363.	There are still a number of kinks in the programme and the table to select which services to refer too, was unreadable. It might be beneficial to have more options for actions available to the MW/HV and the possible implications of those actions once chosen that path, even perhaps an entire pathway of how badly it could turn out ie dad becoming aggressive so you have to leave, or another route whereby your actions don't provoke etc.him
364.	some of the text was unreadable. Sometimes when clicking on the alarm or the gut feeling to something you had just noticed, the text that came up in response was not always relevant to what i had seen. walking around was a little bit 'clunky' and not as easy as id like to maneuver [sic] the time it took to log in to the VRLE was also really quite long, and sometimes it completely froze meaning i had to start again from scratch.
365.	Too long and complex to set up, would have much rather just put in the extra effort to have a physical lecture or just voice recorded one
366.	Uses a lot of laptop energy!!
367.	A nice foundation, but certainly lots of room to expand the grey areas.
368.	It is ok as long as your computer has the capacity as sometimes it could be quite slow and drained my laptop battery but otherwise worked well to improve my knowledge/ skills and confidence in these cases if I were to come across this in practice.
369.	I thoroughly enjoyed this one today
370.	Very glitchy, found I was going through walls or getting stuck a lot. A good premise but hard to use and frustrating due to glitches.
371.	A good platform for distinguishing safeguarding issues
372.	I think this is a great way of learning. It allows you to think carefully and appropriate ways of approaching questions.
373.	I think that it would be good to try and set up your own responses rather than clicking pre-set ones if there is a way to do that somehow. I found the software difficult to move around and work but this might be easier using a headset rather than the mobile device. I did like the way it had links to resources.
374.	it gives you experience that you may not see in practice

375.	I think the VRLE is the perfect way to teach students how to respond to parents and how to approach difficult topics. I find identifying the concerns quiet straight forward, I have 2 children and some education around child's health etc so identifying issues isn't a problem. Approaching them is very alien to me. I'd love to use this more to see examples of how what to say/ how to phrase things etc
376.	I really enjoyed the VRLE it is a fresh new way of learning and really helps put yourself in the environment
377.	I had some technical problems such as having to redownload the app and possibly losing WiFi which meant it froze and I had to restart! These were quite annoying however when it worked it was good.
378.	I think that the system is slow and ineffective and I do not think that it should be the only option for learning sessions. Although some people may like these sessions and find them beneficial, others don't and I feel it is not an effective way to engage their time if they don't find this resource useful
379.	it did glitch a bit
380.	Really helpful resource
381.	It would be handy if you could take notes as you go on the VRLE, of things that are of a concern.
382.	Please make it more sustainable and flow better as very glitch and jumpy
383.	Personally I did not find this helpful, maybe because everything is online at moment. It didn't make much sense without the full classroom based lesson to supplement it. Came away feeling more lost with it all
384.	Would have been better to have done the work when I accessed it two nights ago, or if the work was accessible prior to session, for me
385.	I think the VRLE was great! It worked perfectly on my laptop and had no technical difficulties at all. It was really helpful using the multiple question on how to respond. I think you should ignore the people who had technical difficulties as this does not impact the positive experience and the learning that can be achieved by using VRLE. Would love to have more examples to be able to use in our spare time.
386.	It might be helpful to have different families with less obvious needs sometimes
387.	Thank you for the experience!

Appendix 8: concept testing (phase zero) quantitative data

Jisc Online surveys

urinalysis: pre use (Concept testing doctorate pilot)

Showing 20 of 20 responses

Showing **all** responses

Showing **all** questions

Response rate: 200%

1 What technologies have you used in your previous classes or are using in any of your current classes?

Technology	Count
a. Email	19 (95%)
b. Discussion boards	19 (95%)
c. Chat room	3 (15%)
d. Video conferencing	3 (15%)
e. Mixed reality	0
Other	2 (10%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

1.a Please use this area if you wish to add more info about your answer.

Showing all 4 responses	
Facebook groups	364476-364467-40246031
I have used adobe connect classroom with the Open University.	364476-364467-40477458
In my studies with the Open University we used a teaching platform with adobe. It was very ineffective when it didn't work, which was often, however when it did it enabled all students to interact at a time a place convenient to them, gave us the ability to partake in mid session quizzes, assessing our uptake of knowledge and also break off into groups. A fab way of learning!	364476-364467-40514845
chat room = whatsapp and facebook	364476-364467-40667218

2 Do you have any previous experience using virtual reality technology?

1 / 4

a. No — 15 (75%)
b. Yes - Cardboard headsets — 0
c. Yes - other type of headset — 2 (10%)
d. Mobile device without headset — 3 (15%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

3 Please rate how interested you are in using virtual reality as part of your learning, using the following numbers:

1. extremely interested — 8 (40%)
2. fairly interested — 9 (45%)
3. somewhat interested — 2 (10%)
4. not interested — 1 (5%)
5. don't know — 0
Other — 0
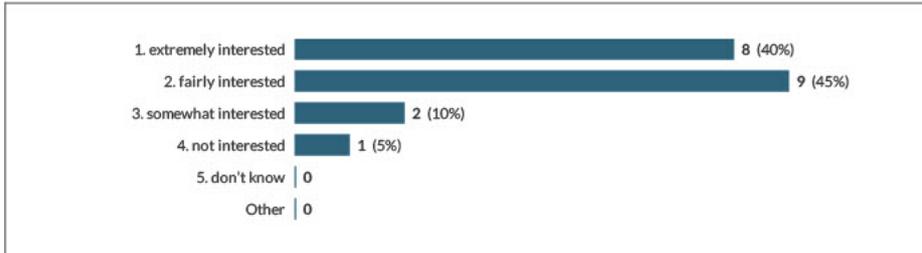
3.a Please use this area if you wish to add more info about your answer.

No responses

4 After your in class / lab sessions on clinical skills, how confident do you feel about remembering how to perform these skills when out on rotation to your clinical placement areas? Please answer this question based on the presumption that there is a gap between your in class sessions at Uni and going out to learn in your clinical placement areas. If you wish to state how long the gap is between the two then you may do so in the box below.

Very confident — 0
Fairly confident — 7 (35%)
Unsure — 11 (55%)
Not at all confident — 2 (10%)
Other — 0
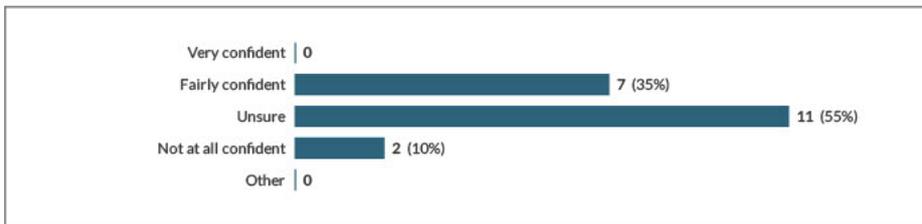
4.a Please use this area if you wish to add more info about your answer.

No responses

5 Do you think that Virtual Reality Learning Environments (VRLE) can help improve confidence in clinical practice??

Answer	Count
Yes	17 (85%)
No	1 (5%)
Unsure	2 (10%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
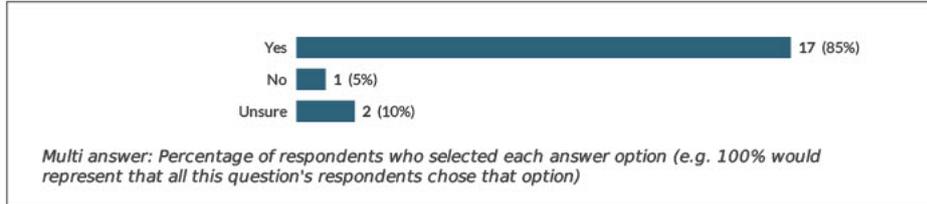
6 Do you think that use of Virtual Reality Learning Environments (VRLE) can help bridge theory / practice gap?

Answer	Count
a. Yes	18 (90%)
b. No	1 (5%)
c. Unsure	1 (5%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
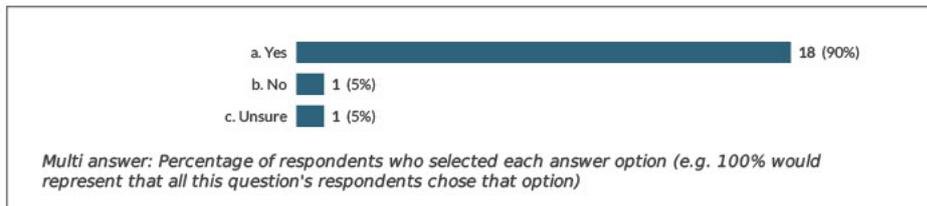
7 Do you think that use of Virtual Reality Learning Environments (VRLE) for practising clinical skills will help to familiarise you with clinical skills?

Answer	Count
a. Yes	19 (95%)
b. No	1 (5%)
c. Unsure	0

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

8 Do you think that use of Virtual Reality Learning Environments (VRLE) for practising clinical skills will help familiarise you with clinical knowledge??

a. Yes	16 (80%)
b. No	1 (5%)
c. Unsure	3 (15%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

9 Do you think that use of Virtual Reality Learning Environments (VRLE) for practising clinical skills will help familiarise you with clinical reasoning?

a. Yes	11 (55%)
b. No	1 (5%)
c. Unsure	8 (40%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

10 Would you like to tell the researcher anything else?

| a. yes | 2 (10%) |
| b. no | 18 (90%) |

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
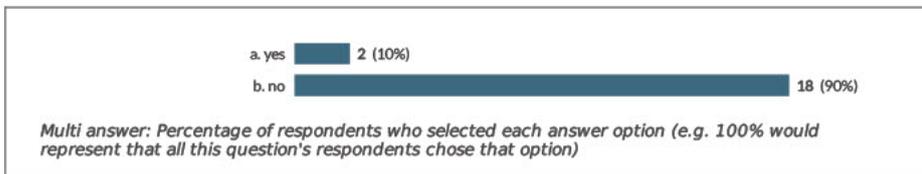
10.a Please use this area if you wish to add more info about your answer.

Showing all 3 responses	
I think it will really help kinaesthetic learners like myself.	364476-364467-40248238
Personally I am a very visual learner and information sticks when i can 'see' it in action - VR sounds ideal for learners like myself	364476-364467-40592719
I think a virtual learning environment would be of huge benefit in cementing skills and knowledge. As students we only get a brief time in the skills lab and then are not allowed back in again to go over or recap things so this indeed could bridge the gap in learning	364476-364467-40695107

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400

Appendix 7 continued: concept testing (phase zero) quantitative data

Jisc Online surveys
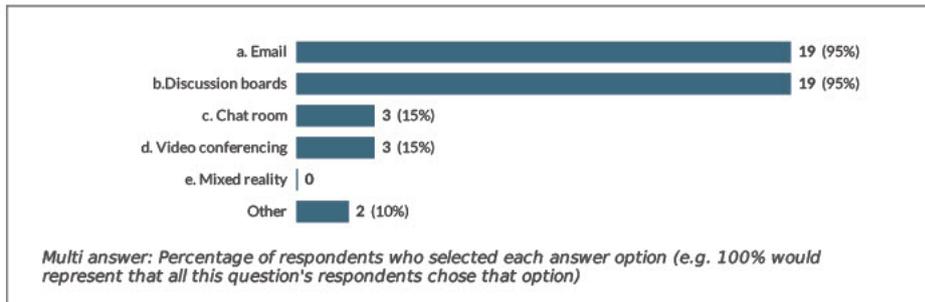
urinalysis: post use (Concept testing doctorate pilot)

Showing 10 of 10 responses
Showing **all** responses
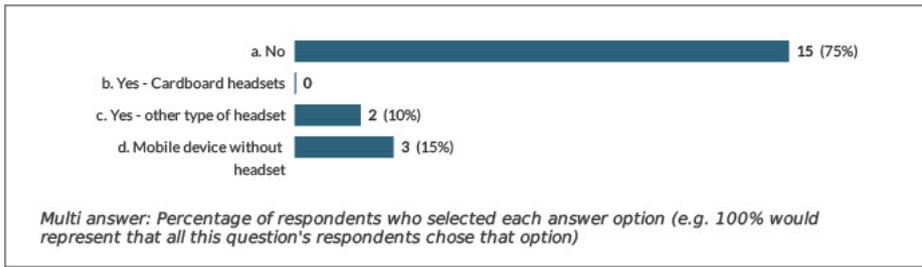Showing **all** questions
Response rate: 100%

1 Please rate your interest in using more Virtual Reality Learning Environments (VRLE) for learning / practising skills using the following numbers:
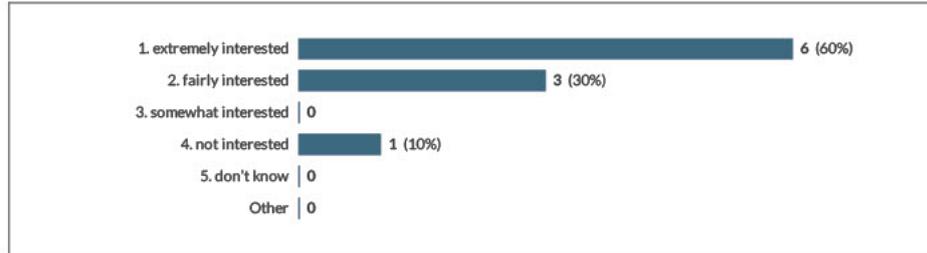
1. extremely interested	6 (60%)
2. fairly interested	3 (30%)
3. somewhat interested	0
4. not interested	1 (10%)
5. don't know	0
Other	0

1.a Please use this area if you wish to add more info about your answer.

Showing all 2 responses	
I found it very useful to use.	416034-416025-41692927
I really enjoyed using it and found it very realistic and informative	416034-416025-41758493

2 Please rate your confidence in urinalysis clinical skills before going onto placements after you had used the Virtual Reality Learning Environment (VRLE)

1. extremely confident	4 (40%)
2. fairly confident	4 (40%)
3. somewhat confident	1 (10%)
4. not confident	1 (10%)
5. don't know	0
Other	0

1 / 5
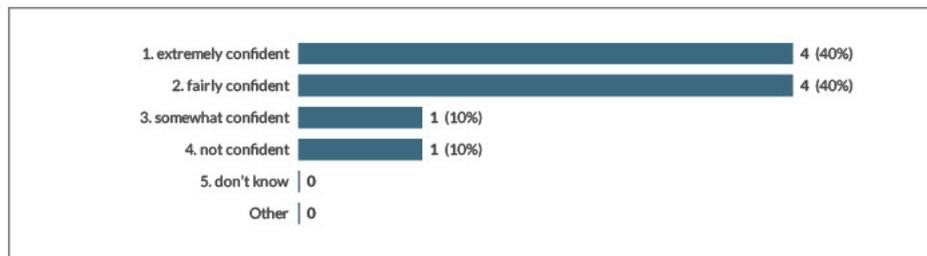
2.a Please use this area if you wish to add more info about your answer.

Showing 1 response	
I did have a query regarding the usage of aprons this does not seem to be common practice in community AN appointments from my experience.	416034-416025-41470487

3 Please rate your belief that the Virtual Reality Learning Environment (VRLE) helped improve confidence in clinical practice for urinalysis

Improved confidence   7 (70%)
Did not improve confidence   2 (20%)
Unsure   1 (10%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
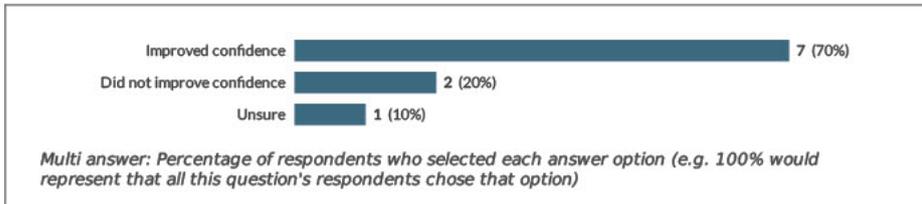
3.a Please use this area if you wish to add more info about your answer.

Showing all 2 responses	
Reinforced learning from classroom, tested what knowledge was already gained and reaffirmed to build confidence	416034-416025-41562292
It explained what I had to do and why and what the results show so it taught me quite a lot.	416034-416025-41692927

4 Please state whether or not you belive that use of the Virtual Reality Learning Environment (VRLE) for unrinalysis helped bridge the gap between learning the theory and going out into practice

a. Yes   10 (100%)
b. No   0
c. Unsure   0

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

4.a Please use this area if you wish to add more info about your answer.

2 / 5

402

5 Please state whether or not you belive that use of Virtual Reality Learning Environments(VRLE) for practising urinalysis clinical skills helped to improve patient safety during your real life clinical care

a. Yes   5 (50%)
b. No   1 (10%)
c. Unsure   4 (40%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
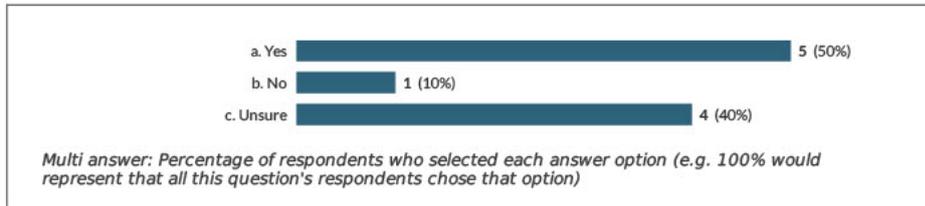
5.a Please use this area if you wish to add more info about your answer.

No responses

6 Please state whether or not you believe that use of the urinalysis Virtual Reality Learning Environment (VRLE) helped familiarise you with those clinical skills

a. Yes   10 (100%)
b. No   0
c. Unsure   0

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)
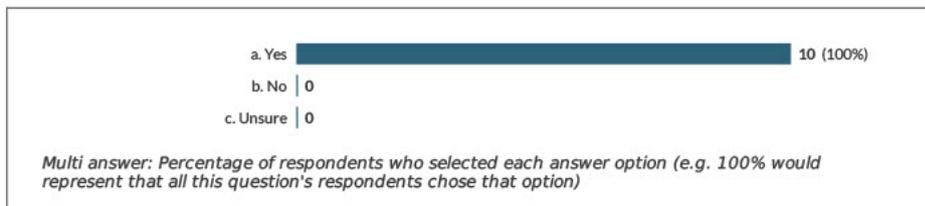
6.a Please use this area if you wish to add more info about your answer.

No responses

7 Please state whether or not you belive that use of the urinalysis Virtual Reality Learning Environment (VRLE) helped familiarise you with clinical knowledge

a. Yes   9 (90%)
b. No   0
c. Unsure   1 (10%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

7.a Please use this area if you wish to add more info about your answer.

Showing 1 response	
The amount of information flagged up regarding possible effects of different urine types was a LOT to take on board. It might be nice if there was a multiple choice questionnaire such as - the urine is: Odourous Cloudy Had red in it Etc - then a multiple choice set of answers to choose from when one is selected. Ie urine is cloudy - this indicates a, b, or c and then what can be done or offered	**416034-416025-41470487**

8 Please state whether or not you belive that use of the urinalysis Virtual Reality Learning Environment (VRLE) helped familiarise you with clinical reasoning

a. Yes   7 (70%)
b. No   1 (10%)
c. Unsure   2 (20%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

8.a Please use this area if you wish to add more info about your answer.

No responses

9 Did the urinalysis Virtual Reality Learning Environment (VRLE) help you to learn something new?
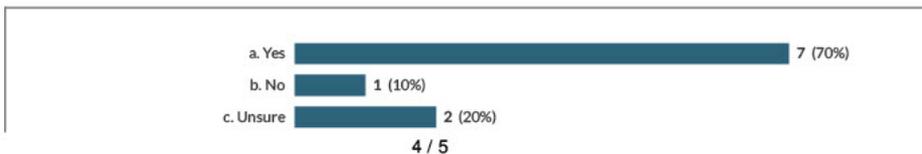
a. Yes   7 (70%)
b. No   1 (10%)
c. Unsure   2 (20%)

4 / 5

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Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

9.a Please use this area if you wish to add more info about your answer.

No responses

---

10 Would you like to tell the researcher anything else?

a. yes	2 (20%)
b. no	8 (80%)

Multi answer: Percentage of respondents who selected each answer option (e.g. 100% would represent that all this question's respondents chose that option)

10.a Please use this area if you wish to add more info about your answer.

Showing all 2 responses	
I believe traditional kinesthetic learning would be preferable for all clinical skills. I would not like to see that being lost but i do think it is a viable option for bridging the gap. However as an additional not as replacement for conventional learning	416034-416025-41424247
Found the virtual environment did not necessarily teach me new things, it was confidence building and reaffirmed knowledge. It bought to life universal precautions, techniques and clinical knowledge in a meaningful way, especially for visual/practical learners.	416034-416025-41562292

5 / 5

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Appendix 9: Concept testing (phase zero – prior to the doctoral research for this thesis) qualitative data

1.	S1 - Yes that's the word ..... avatar. I chose my avatar and then couldn't go anywhere. I was kind of stuck in a wall .....
2.	S2 - Oh yeah.
3.	S1 - ..... or a window or .....
4.	S2 - Yeah.
5.	S1 - ..... something. It didn't ..... I don't know whether it because there's a next icon that comes up in the bottom corner and that didn't come up for ages and I don't know whether that was just a me issue.
6.	S2 -Did you do that first or did you go to the other bit where you learn how to use it because I did it .....
7.	S1 - No I chose my avatar .....
8.	S2 - .... back to front.
9.	S1 -.... and then went on to the learn to use it. Oh right ok. I went to the room and then got stuck at the sink and I couldn't .....
10.	[Laughter]
11.	S1 - .... because I didn't know how to get it back so yeah a good tip is to go .....
12.	S2 - Find the tutorial.
13.	S1 -..... yeah the tutorial was important.
14.	[Laughter]
15.	S2 - Yeah I know. The tutorial was good though. I think it was quite well instructed, I didn't feel that I was like "oh my goodness I don't know what I'm gonna do now" and, and it was simple enough that even an idiot like me could plough through doing it.
16.	S1 - Hmm. Yeah but with the urinalysis thing ..... I think the thing that I felt actually was um ..... it was it was good, it was interesting and it reiterated what we'd learnt and it's good to keep up the sort of the technique or the practical side of it um and then it throws in the bits of theory but I did find that at one point the theory bit got quite heavy, there was loads and loads of stuff to read as opposed to um ..... if perhaps you do it some by some there's multiple choice so say for instance you do the test and oh there's a little.... it shows up as a little bit of protein um what could this demonstrate and maybe there's a selection of answers.
17.	S2 - ..... makes it quite heavy reading that which is what I thought cos you know you read that bit and then you click next and then there's a

	whole another load of ah but actually if the urine had been this, it could be this, you know and .....
18.	S2 - Oh so it shows it all rather than you having a stick and then say it comes up with leucocytes .....
19.	S1 - and then it explains that .....
20.	S2 -..... so it makes you have a think about what it yeah what the options could be so that's all sort of what I thought another way of making it more interactive cos I find personally practical stuff and interaction makes me learn better than sitting and just reading, reading, reading.
21.	S1 - Potentially or you could do, each one could have a different um urine [laughter] you know like one could be cloudy um and or odourless or have, be red or ..... you know so there's different you know so you don't just use it the once you could go in multiple times or .....
22.	S1 - .... or or orrr that you know you dip the stick in, you have the options then of the urine comes out red, there's protein in the urine de de de de de-de so you have the options then so you could say oh the urine was red and then with that, what is this a sign of de de de? You know, maybe like that?
23.	S2 - Or even you could have the different clients in, Mrs H. came in feeling unwell today, you dip her urine
24.	S1 - ..... and there's leucocytes and nitrate in it or whatever .....
25.	S2 - .... what would you do? I think maybe it would be more user-friendly if you did separate clients .....
26.	S1 - Separate ..... yeah.
27.	S1 - ..... and then you could set up a whole different scenario couldn't you.
28.	S2 - Hmm ..... cos sometimes I just feel if there's a lot of reading and you've got nothing to put it to, it's just words, if that makes sense?
29.	S2 - But I quite like the process, I very much learn visually and I like being able to see a process of what you are going through from beginning to end and you can just visualise that to help you .....
30.	Hmm.
31.	S2 - ..... to perform it.
32.	S1 - Yeah, I also like the little tips on what's the nicer way of greeting the woman um as opposed to just "come in" [laughter] you know you go to the door and welcome them and "take a seat" and um all the rest of it. That was quite nice.
33.	S1 - Then the interruption wasn't there.
34.	Yeah.

35.	S1 - There was a knock at the door and how you would handle that.
36.	Yeah.
37.	S1 - I think it brought other things in, not necessarily just that one task that you were focusing on.
38.	S2 - I liked to fly.
39.	S2 - Well, no not the clinic room, oh I didn't think, could you do that?
40.	S2 - It's just a try that. I was trying to make the woman run ..... [laughter]
41.	S1 - Oh were you.
42.	S2 - ..... but it wouldn't let you double-click .....
43.	S1 No.
44.	S2 - .... sometimes.
45.	S2 - That was in the tutorial bit you could make them fly couldn't you and largely you'd end up .....
46.	S1 - Face down .....
47.	S2 - .... face down .....
48.	S2 - .... in the yellow circle.
49.	S1 - but at least you made it to the circle .....
50.	S2 - Yes true.
51.	S1 - .... that's half the battle.
52.	S2 - Um ..... yeah I enjoyed it. Overall I thought it was good, a couple of times, like I said, I did get jammed and I was sort of stuck sort of half behind a wall like you know but I think it's just sort of getting to grips with the you know how to move the people around and more than .....
53.	S1 - It's quite a small environment because in games and things, obviously it would be in a much bigger world .....
54.	S2 .... whereas your world was constricted to one clinic .....
55.	Hmm hmm.
56.	S1 .... um so I also get stuck behind the wall sometimes and .....
57.	S1 .... I'm quite familiar with it .....
58.	S2 ..... it's just that because we are working in such a small environment .....
59.	S1 Yeah.

60.	S1 Yeah I think it's a bit clunky if you're doing it that way .....
61.	S2 ..... so in a way you're kind of just walking around so I can imagine with the headset .....
62.	S2 .... or something .....
63.	S2 ..... it would be quite good.
64.	S1 Yeah, the only other thing that I did question with it was the um use of the apron because I don't think we've been told to use aprons with urinalysis have we?
65.	S2 Yes.
66.	S1 Have we?
67.	S2 I think so.
68.	S1 But I've asked .....
69.	S2 We use it with all the body fluids.
70.	S1 ..... the midwives, I also asked the Academic Adviser, like for the tripartite, and she said "well no, people don't tend to use the aprons".
71.	S2 Yeah I think D.... said .....
72.	S1 But people **should** because .....
73.	S2 They should.
74.	S2 No she did .....
75.	S2 Yeah.S1 ..... she did say that we should I think now thinking about it. I just wondered because um I mean however many times you do urinalysis throughout the day you know how many pairs of gloves and aprons and .....
76.	DK Because how many microscopic splash do you get on your uniform though [sigh] and things like you know and thinking of transferring infections because that's why this is the proper teaching of .....
77.	S1 So it's controlled standards.
78.	It is .....
79.	Yeah.
80.	S1 Hmm.
81.	S2 Ok good.
82.	S1 ..... all that sort of thing.
83.	S1 I think like you said, maybe having different scenarios to go into um .....

84.	S1 So you are not ..... yeah you're not just telling us the information, you are making us work for it [laughter] a little bit and test our knowledge and obviously if you get it wrong, you get it wrong but perhaps you'll remember it the next time.
85.	S1 - Or maybe do it in a less ..... it felt a little bit spoon-fed, a little bit not challenging, it didn't rely on you remembering stuff which is good for your first time but I think as you did it more you would probably want .....
86.	S1 - ..... a little bit more of the challenge for it.
87.	S1 I think that would be a good idea .....
88.	S1 ..... actually and especially because um well I suppose we'd still be using it, we've not done Labour Ward .....
89.	Hmm hmm.
90.	S1 ..... or anything like that so presumably we would still test women during clinic .....
91.	S2 Absolutely.
92.	S1 ..... yeah but I was thinking sort of more with Community, we're not there that often so it's good to keep in the practice of things but I think for a beginners level you know it would be nice to have actually different levels wouldn't it .....
93.	S2 Yeah.
94.	S1 ..... and then test your knowledge it becomes harder as it goes on.
95.	S2 And maybe even things like I don't know say a Theatre environment where actually it's quite scary to go into there for your first time .....
96.	S1 Hmm.
97.	S2 ..... and actually if you've got a little bit more of a feel for what you are going into .....
98.	S2 ..... that would probably be quite comforting.
99.	S1 Yes we had them this last week haven't we so.
100.	S2 Yeah and I guess things like err you know a system with epidurals and even things like that, if you can just see your trolley and the things that you need to have on it sometimes that's half the battle isn't it?
101.	S2 Or you go and gather the bits that you need and .....
102.	S1 And if you don't have to use .....
103.	S2 ..... in what order you open them in and that kind of thing.

104.	S1 ..... and if you are not using up supplies I guess that ..... as a process it is quite good.
105.	S2 Yeah cos I think the downside to learning is the practical side because until you are out you know on placement, you know you get one sort of hour and a half lesson in Uni, so like last Friday we had venepuncture, we had ..... what did we have ..... catheterisation .....
106.	S1 Catheterisation and injections.
107.	S2 ..... yeah and so in that lesson you sort of think "oh yeah, yeah, ok, ok I can do this", step away from it and a few weeks later, could you remember the order that you have to open all the catheterisation stuff, so that's when this is as like a secondary source of practice.....
108.	S1 Yep.
109.	S2 ..... I think would really benefit us as students. I mean obviously the more you go on perhaps the less you would have to use it or, as you say, if you did different levels it sort of the questions are harder and um yeah I actually think that would help a lot.
110.	S1 And there's no pressure is there because you can .....
111.	Exactly.
112.	S1 ..... get it wrong and that's ok.
113.	S2 But I think that that would be good too, if you do it wrong you just get a little bit of "oh so have you forgotten this?" or you know little prompts to remind you that you should have put the gloves on or you should have washed your hands after that or .....
114.	S1 Because on this one you just can't go ahead.
115.	S2 You had to do it didn't you, you had to do each step.
116.	S1 I don't um ..... I don't know, what do you think cos I think sometimes you learn from doing wrong.
117.	S2 Hmm hmm.
118.	S1 Doing something wrong.
119.	S2 I agree.
120.	S1 So when we were doing catheterisation, we were putting the stuff out and quite often somebody would do something wrong or they they'd forget this bit and then you kind of go "oh" and then suddenly you think "oh yeah I wouldn't be" you know you think I won't forget that next time but the bits you did right perhaps you will forget.
121.	S2 Hmm hmm.

122.	S1 Do you know what I mean?
123.	S2 Hmm hmm.
124.	S1 Um but the bits that you do wrong generally you kind of think "oh yeah I did that last time I won't do that next time".
125.	S2 Cos it did lead us very much into you know go and wash your hands, find your gloves .....
126.	S1 Yup.
127.	.S2 .... and this, whereas perhaps a little bit more free flow if there's the capability for that is right .....
128.	S1 Yeah.
129.	.S2 .... you know how are you going to start this process so .....
130.	S1 Yeah or there are like 7 stages .....
131.	S2 Yeah there's 7 steps, where do you start? sort of thing.
132.	S1 What are you going to get?
133.	S1 Yeah or even down to the urinalysis you know, your lady comes in and it's the onus is much more on you to make the first move to be the decision maker rather than the programme prompting you to go to the sink to wash your hands actually use .....
134.	S2 So what should you do next?
135.	S1 And it's simple things isn't it that and that's probably the bits in your assessments that you're gonna be so focused on the clinical side of it that maybe you'll forget that you know to wash your hands to put your gloves on.
136.	S2 Yeah that's what I mean by it is the practice that we're lacking almost because it's all and well and good knowing the theory but it's the practice [laughter] that you know, midwifery is a very practical thing isn't it.
137.	S1 Hmm, well we have to think a bit ourselves as to what you know and oh hang on should you have done that then or is there a step you should have .....
138.	S2 Yeah I think that could be like a you know a step up level thing is the first one actually it does talk you through it and then maybe .....
139.	S1 ..... is you walking your way through it and it just backing you up so "oh you know whoops not yet .....
140.	S2 "Whoops .... do this".
141.	S1 ..... try again".

142.	S2 No I think you should be corrected because I think you learn from that correction don't you.
143.	S1 Yeah. I don't think cos you wouldn't, you wouldn't want to carry on in a tripartite and then just fail it, you know what I mean, you need to be corrected I think and so that .....
144.	S1 And it may be the same thing that you forget mightn't it .....
145.	S2 ..... you have that in your mind that oh yeah that's right .....
146.	S1 Yeah.
147.	S2 ..... and if you're picked up at the point you forget it .....
148.	S1 ..... a review and then I know it's only a pilot but what do you feel you were able to learn while you were doing this virtual reality learning environment because for you guys it was quite some time after you'd had your urinalysis training .....
149.	S2 I think yeah I think it was um ..... there was information on what was found or potentially could be found in urine.
150.	S1 Yeah it's that almost kind of recap isn't it that .... you know you've done it and you've been out in practice and you've seen how it is out in practice and you may not have seen certain things come up on a urinalysis and actually it then prompts you for the things that you are looking for doesn't it, it refreshes that.
151.	S2 Hmm ..... yeah there should also be a question, I don't remember if there was or not but where you dispose of the urine, what you do with it, what the options are.
152.	S1 There is a question.
153.	S2 Oh is there?
154.	S1 Yeah absolutely because you are right ..... that's it's a big issue ....
155.	S2 It is a big issue [laughter].
156.	.S1 .... particularly in terms of what we are doing to the environment and actually what standard practice is.
157.	S2 Hmm hmm.
158.	S1 Years ago we used to think nothing of just dumping it down the clinic sink, everybody did it.
159.	S2 Yeah and I think that's another issue again isn't it having come, I did mine after I'd done my placement so then again you you've kind of got a little bit of a dilemma of actually of seeing people doing this but this this should be doing this and it's making that ok to almost be a trendsetter and go out and say right ok well I'm going to wear gloves and an apron to do this.

160.	S1 Because you've been told it's ok and actually that's an expectation of you as a student midwife and then once you've done it for 3 years you just become known as the midwife who .... gloves up and .....
161.	
162.	S2 Yeah.
163.	S1 .... puts an apron on all the time.
164.	S2 Yeah, the expensive midwife.
165.	Yeah [laughter].
166.	S2 No I just quite like ..... as a concept I really liked it and I kind of you can see how it can progress for your learning and for future I think it will be a really reassuring tool.
167.	S1 Hmm ..... yeah.
168.	S2 With all sorts as well I think, with um ..... it could be used for all sorts of practical .....
169.	S1 Hmm.
170.	S2 ..... side of midwifery.
171.	S1 Because especially as .....
172.	S2 Yeah.
173.	.S1 .... as a first year student it's very overwhelming especially when the first, so for instance our first lesson we had neonatal resuscitation, that was our very first lesson, an hour and a half on that now it's sort of how long have we been here sort of, say 9 weeks for arguments sake, you know, could I remember the order to do it in? Not necessarily without having to go back through the notes and read it all but something like this you see you could just jump online, jump onto the thing and just go through it and go "that's right" you know it would be really easy to have as a sort of a mini crash course and reminder session.
174.	S2 And it's like a direct access isn't it, you haven't got to plough back all through your notes .....
175.	S1 That's it. You haven't got to read it and go .....
176.	S2 .... or you can just look at your notes and think right I'm going to go into the environment and .....
177.	S1 Yeah.
178.	S2 ..... ploughing through your notes or look it up somewhere?
179.	S1 Because it's a one stop shop isn't it actually with information .....

180.	S2 And it's practical you can physically see it and that is I think you know the majority of people probably learn better that way .....
181.	S1 Yeah.
182.	S2 ..... than having to ..... you know and you write things you know and especially when you are being told stuff in lectures you know you're writing things but you might have missed a step or you know it might not you look back and sometimes go "ooh what did I mean by that, that made sense at the time I'm sure but ..... but now hmm".
183.	S1 And a lot of the clinical skills are things that you're better off knowing and you know and repeating a process rather than reading loads of words that don't mean anything .....
	That's excellent thank you so much for your time I really appreciate it.
184.	S3 I found it easy to use, you didn't have to worry that you were going to do something wrong .....
185.	S4 Hmm.
186.	S3 .... it was quite a easy to use programme, does that make sense?
187.	S5 I would disagree with that, I don't know if it was **my** laptop but I found it very difficult to manoeuvre the person around to find like the sharps bins .....
188.	S3 Hmm.
189.	S5 ..... and stuff like that, I found it really difficult to get to grips with that. However I **did** like the information that we got .....
190.	S4 Hmm.
191.	S5 ..... about why we were doing stuff, I thought that was quite good.
192.	S4 Y eah I'd agree with that ..... definitely.
193.	S1 Yeah me too.
194.	S5 Hmm.
195.	Moderator asks for clarification - So the 3 of you are agreeing that it was difficult to use?
196.	S5 Difficult to manoeuvre and to know the areas to click on. I think sometimes you were clicking on things that you didn't necessarily need to be clicking on, like it said um for example like "wash your hands" and it didn't say "click on something to show that you are washing your hands". Ok.
197.	S4 Yeah on the area that you were supposed to click on .....
198.	S5 Hmm.

199.	S4 ..... for something to come up so I found myself kind of clicking the mouse sort of around the sink until a box come up with the dialogue and telling you what the next step was or why you did that but the information was all good to say why you were doing you know washing hands, why you were using .....
200.	S3 Yeah.
201.	S4 ..... gloves and things like that.
202.	S3 I think it was good that there was a video as well like showing you the correct technique of washing hands.
203.	Hmm.
204.	Moderator prompt - Ok. Anything else?
205.	….Long pause….
206.	Moderator prompt Ok. What did you enjoy using about it then?
207.	S4 I think it makes you feel more prepared for when you've gotta actually go and do it like in practice .....
208.	S3 Yeah.
209.	S4 ..... you know what you're doing and why you're doing it.
210.	S3 Yeah I think it can definitely be used as that intermediate between the classroom .....
211.	S5 Hmm.
212.	S3 ..... and going into practice that sort of bridging the gap tool. I wouldn't say you could use it as an absolute tool to learn how to do urinalysis, you have to be able to do it and practice it in real life as well but for bridging the gap I did think it was quite useful.
213.	S4 ..... so that way you you've kind of got that stage so you are learning in the classroom where your you've got your supervisor, you're being told how to do it and then you've got this opportunity where you're not going to make a mistake by yourself, so you'll sort of be doing it more independently and it gives you more confidence for when you are actually out in practice and you **are** doing it for real. Does that make sense?
214.	S1 Yeah I agree.
215.	S3 I agree with you as well.
216.	S5 Sometimes like when you are doing things on the computer like that, if you're over the right area the curser will change shape or something, like it might change from an arrow to a hand so you would know you're on the right space to click you know .... so it was quite tricky to know.

217.	S3 Hmm.
218.	S4 Yeah.
219.	S5 I found it was more moving the actual figure that was the difficulty like um looking around the room when you were in like the first person so you were seeing it through her eyes. I found trying to look around like that really really hard .... I don't know again if that was my laptop.
220.	S4 No I agree as well. I stayed in 3rd person because it was too hard to do everything.
221.	S3 I just stayed in 3rd person anyway so ..... I think I just stayed, I didn't realise you could change the [laughter] view ..... actually.
222.	S4 ..... that's how I sort of play games and stuff like that I go .....
223.	S5 I did know how to change it I just didn't go into first person.
224.	S3 Yeah, this was my first time doing ..... something like this so I did do both views to see which I got on with best but yeah I just found that the first person one was really really hard to use.
225.	S4 Yeah. I find that even with like playing on say like the PlayStation, even like really popular famous games, I find first person is like a dizzying experience .... anywhere so I didn't even go to press on it I just did 3rd cos I know I have like a better viewpoint that way.
226.	Moderator question - You all used your laptops?
227.	All - Yeah.
228.	S3 Like it was rather than just reading like a list of like 1) do this, do that, it was like obviously the virtual reality of actually going and doing those things so.
229.	S4 I don't seem to remember there was/whether there was a patient, whether there was a woman [laughter] in the room or not.
230.	S5 There was.
231.	S3 Yeah.
232.	S4 Because I don't think .....
233.	S35You had to welcome her in.
234.	S3 I don't even think I remembered seeing a ..... woman.
235.	S4 If you got as far as washing your hands .....

236.	S3 I did. Yeah.
237.	S4 .... yeah then she was definitely in the room .....
238.	S5.... definitely in the room oh .....
239.	S4 ..... because you have to welcome her in the room before you can go and .....
240.	S3 So would that have meant that I was looking at looking at it from a different view then?
241.	S5 I think you are automatically in third person.
242.	S4 When you're in the room she would have been sitting over here .....
243.	S1 Ok.
244.	s4 .... and where you are is where the sink would have been so you might have had your back to her perhaps at the sink and ..... Oh maybe .....
245.	S5..... and maybe looking at the desk.
246.	s3 .... I don't remember seeing a woman.
247.	[Laughter]
248.	S3 Oh there she is! [Laughter]
249.	S5 It would be useful to do, I think it would be useful for something like um venepuncture .....
250.	S3 Yeah.
251.	S4 Hmm.
252.	.s5 .... because when we were in the um ..... we're doing clinical skills we literally get one practice at it .....
253.	Yeah.
254.	S5 ..... and the next time we do it is on a real person and apart from going home and sort of reading books and seeing the process, to actually have something like that for quite a nerve wracking .....
255.	Hmm.
256.	.s5 .... um skill to develop .....
257.	S3 Yeah. ..... would be really useful. …for the order of the steps, what to get and .... like you were saying with the gloves.
258.	S4 With catheterisation especially .... because ..... there are so many. ..... you have to do that there are just so many different steps .....

259.	S3 ..... and like you said we only get one actual physical go before we are expected to do this in in real life so getting those steps down is where .....
260.	S4 Yeah.
261.	.s3 .... this would really help.
262.	S5 Undoing a sterile pack even something like that .....
263.	S4 Yeah.
264.	S5 ..... I think would be useful to .....
265.	S3 Yeah.
266.	S5 ..... practice virtually because there isn't any other way of practicing it apart from in a Skills Lab and .... we don't do that very often.
267.	S3 I still think you know we get the hands-on feel of it from the time we have in the Skills Lab .....
268.	S5 Hmm, hmm.
269.	S5 ..... but then yeah, just remembering **all** the steps, this is good for that.
270.	S3 Yeah but it's like the tor.... putting the tourniquet on .....
271.	S4 Yup.
272.	S3 ..... and then what you've got to put together you know all the different parts of it .....
273.	S4 Yeah, needles .....
274.	S5 ..... and getting the bottles, labelling the bottles.
275.	S4 ..... and what does each bottle mean .....
276.	S3 Yeah.
277.	S5 ..... which ones you are doing and which ones you check and which ones you don't and .....
278.	S3 Because that was now a couple of weeks ago .....
279.	S5 Yeah.
280.	S3 ..... and we don't go into practice for a month so the gap .....
281.	S5 And we're going to be expected to do it.

282.	S4 Yeah.
283.	S3 ..... and we're going to need to remember all of those things, obviously we're going to go back to a book or notes that we've taken, PowerPoints .....
284.	S4…From the mentor.
285.	S3 ..... then have a look at the steps but actually to practice virtually will be really handy .....
286.	S5 I just, I really just wanted to stress that I **do** think with whatever skill this can be made to do, we still should have to do it physically in the Skills Lab. I don't think we can lose that I think that's really really important to have the hands-on but it is definitely a good thing for like what I call bridging the gap.
287.	Moderator prompt - Ok, anything else? Ok I'll stop recording now.
	Questionnaire – pre use
	Q1 - What technologies have you used in your previous classes or are using in any of your current classes?
288.	In my studies with the Open University we used a teaching platform with adobe. It was very ineffective when it didn't work, which was often, however when it did it enabled all students to interact at a time a place convenient to them, gave us the ability to partake in mid session quizzes, assessing our uptake of knowledge and also break off into groups. A fab way of learning!
289.	I have used adobe connect classroom with the Open University
290.	chat room = whatsapp and facebook
	Would you like to tell the researcher anything else?
291.	I think it will really help kinaesthetic learners like myself.
292.	Personally I am a very visual learner and information sticks when i can 'see' it in action - VR sounds ideal for learners like myself
293.	I think a virtual learning environment would be of huge benefit in cementing skills and knowledge. As students we only get a brief time in the skills lab and then are not allowed back in again to go over or recap things so this indeed could bridge the gap in learning
	Questionnaire – post use
	Q1 Please rate your interest in using more Virtual Reality Learning Environments (VRLE) for learning / practising skills
294.	I found it very useful to use.
295.	I really enjoyed using it and found it very realistic and informative
	Q2 Please rate your confidence in urinalysis clinical skills before going onto placements after you hadused the Virtual Reality Learning Environment (VRLE)
296.	I did have a query regarding the usage of aprons this does not seem to be common practice in community AN appointments from my experience
	Q3 Please rate your belief that the Virtual Reality Learning Environment (VRLE) helped improve

	confidence in clinical practice for urinalysis
297.	Reinforced learning from classroom, tested what knowledge was already gained and reaffirmed to build confidence
298.	It explained what I had to do and why and what the results show so it taught me quite a lot.
	Q4 Please state whether or not you belive that use of the Virtual Reality Learning Environment (VRLE) for unrinalysis helped bridge the gap between learning the theory and going out into practice
299.	Safe environment to make errors, in a non-judgmental way. Also boosted confidence by having a baseline knowledge and answering questions posed correctly
	Q7 Please state whether or not you belive that use of the urinalysis Virtual Reality Learning Environment (VRLE) helped familiarise you with clinical knowledge
300.	The amount of information flagged up regarding possible effects of different urine types was a LOT to take on board. It might be nice if there was a multiple choice questionnaire such as - the urine is: Odourous Cloudy Had red in it Etc - then a multiple choice set of answers to choose from when one is selected. Ie urine is cloudy - this indicates a, b, or c and then what can be done or offered
	Q10 Would you like to tell the researcher anything else?
301.	I believe traditional kinesthetic learning would be preferable for all clinical skills. I would not like to see that being lost but i do think it is a viable option for bridging the gap. However as an additional not as replacement for conventional learning
302.	Found the virtual environment did not necessarily teach me new things, it was confidence building and reaffirmed knowledge. It bought to life universal precautions, techniques and clinical knowledge in a meaningful way, especially for visual/practical learners.

Appendix 9 continued - Concept testing (phase zero) qualitative data
Dear all
Thank you so much for taking part in the research on the urinalysis virtual reality learning environment (VRLE). On the whole you have said that the urinalysis VRLE improved your confidence, knowledge and reasoning related to urinalysis when you were in the gap between learning the theory and your clinical practice block.

I am now working on developing the next VRLE which will be related to safeguarding where you will be able to use VRLE to enter a simulated client's home and practice your safeguarding skills there and during a simulated child protection conference.

What I would like to know (in addition to the feedback you have already given me) is: in your own words what way(s) you feel the use of VRLE can impact on patient care in clinical
practice?
Denyse

Reply from NB:
Dear Denyse,
In what way(s) you feel the use of VRLE can impact on patient care in clinical practice?

I feel that being able to access and use the VRLE will increase our confidence in practice because it will allow us, as students, to walk through an entire scenario from start to finish so that when it happens in practice it isnít [sic] the first time. Likewise, if we require extra practice on top of certain scenarios we face in practice, itíll [sic] be a really valuable tool to contribute to our knowledge and experience of a certain area of patient care.

I think that the overall impact will be an improved learning experience for the student and, as a consequence , better care for the patient from a more confident practitioner. I, myself, think that if I had regular access to a virtual learning environment where I could choose areas that I wanted to expand my knowledge on, I would use it regularly alongside practice as well as when studying blocks of theory.

Reply from RM:
Hi Denyse
I personally think that the safeguarding VRLE could prepare us more for when we are in practice. Likewise with the urinalysis it will broaden knowledge and confidence when being putting in these situations. It may help to identify potential issues earlier than we may have done without the practice on the VRLE. Allowing us to go into an environment (in this case a home) where we can practice before being put in a real life situation I think would be beneficial. Practicing conversations, the right questions to ask and the signs to look for could help protect vulnerable people quicker.

It will give an insight into child protection conferences that some newly qualified midwives may not have witnessed previously, this in itself will be less daunting for some possibly. Having the experience of a conference will enable healthcare professionals to explain what the process is to patients and answer any questions they may have.
Practice brings confidence and knowledge, so with regards to patient care I feel it will help towards better communication and trusting relationships quickly.

Appendix 10: Participant information and agreement forms

Participant Information Sheet

version: 3
Ethics ID
number: 23182

The title of the research project

Collaborative Immersive Virtual Reality Series (CILVRS) - Virtual Reality Learning Environments for healthcare students and healthcare professionals

What is the purpose of the research/questionnaire?

This project is intended to support the development of the virtual reality learning environments (VRLE) which are part of the Collaborative Immersive Virtual Reality Series (CILVRS). The VRLE will allow healthcare students and healthcare professionals to practice skills in a virtual clinical environment which may be set in the community or hospital.

This research is exploring the impact of VRLE on clinical skills of healthcare students / healthcare professionals and their perceptions of the associated impact on patient care. All contributions from research participants will be anonymised before publication. The research findings will contribute to changes in educational experiences being offered to healthcare students and healthcare professionals' CPD.

CILVRS is an on-going long-term project at BU and research will be conducted into several different VRLE subjects over the next two years. You are being asked to participate in research for one VRLE from a random choice of environment number 2, 3 or 4, all of which relate to skills required for safeguarding the unborn, children, young people, vulnerable adults and / or families.

Why have I been chosen?

You have been asked to participate in this research because you are a healthcare student or a healthcare professional and have direct experience of learning and practicing clinical skills. Your name has been provided as a suitable person to approach by your unit lead / team leader. The project needs to recruit a minimum of 20 participants for each VRLE and you are being asked to experience a VRLE related to clinical skills required for safeguarding.

Do I have to take part?

Online survey

It is up to you to decide whether or not to take part in the research. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a participant agreement form. You can withdraw from participation at any time and without giving a reason, simply by closing the browser page of the questionnaire. Please note that once you have completed and submitted your survey responses, we

are unable to remove your responses from the study as the information you contribute is anonymised before the Principle Investigator (Denyse King) sees it.

Focus group

It is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a participant agreement form. You can withdraw from participation at any time and without giving a reason, simply by not attending or by not speaking during the focus group. Your contributions to the focus group will be anonymised at the point of transcription and only the Principle Investigator (Denyse King) and her research supervisors will have access to the non-anonymised data.

Deciding to take part or not will not impact upon your education at BU or that of other educational establishments or your position at your place of employment.

How long will the survey /focus group take to complete?

The pre-use survey has 12 questions and the post use survey has 13 questions. Each survey has less should take you approximately !5 minutes to complete. The focus group is expected to last no longer than 30 minutes.

What are the advantages and possible disadvantages or risks of taking part?

It is hoped that this research will confirm that healthcare education will benefit from opportunities to use VRLE which offer clinical experiences and immersion in situations which cannot otherwise be guaranteed. By taking part in this research you may find that your confidence, knowledge and reasoning are impacted in relation to the clinical skills for safeguarding assessment and referral. There are no expected disadvantages or anticipated risks. Should you find the content of the VRLE distressing for any reason, you can access debriefing and support from the Principle Investigator or Dr. Wendy Marsh who is participating in supervision of this research.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

Taking part in this research will include completing a pre-use and post-use survey, use of a virtual reality learning environment and being recorded (audio and video) during the end of project focus group. These audio and video recordings will be deleted once transcribed. The surveys will ask you questions related to your current experience with using virtual reality and your belief in the value of using virtual reality for learning – your feelings about these things will be compared pre and post VRLE use. The focus groups will explore research participants' experience of using the VRLE rather than individual knowledge of clinical skills.

Use of my information

Participation in this study is on the basis of consent: you do not have to complete the survey, and you can change your mind at any point before submitting the survey

responses.   Once we receive your survey response, your personal information is processed in compliance with the data protection legislation. We will use your data on the basis that it is necessary for the conduct of research, which is an activity in the public interest.

Bournemouth University (BU) is a Data Controller of your information which means that we are responsible for looking after your information and using it appropriately. BU's Research Participant Privacy Notice sets out more information about how we fulfil our responsibilities as a data controller and about your rights as an individual under the data protection legislation. We ask you to read this Notice so that you can fully understand the basis on which we will process your information.

Once you have submitted your survey response it may not be possible for us to remove it from the study analysis, as this might affect our ability to complete the research appropriately or the accuracy and reliability of the research findings.

Sharing and further use of your personal information
The information collected about you may be used in an anonymous form to support other research projects in the future and access to it in this form will not be restricted. It will not be possible for you to be identified from this data. Anonymised data will be added to BU's Data Repository (a central location where data is stored) and which will be publicly available.

Retention of your data
All personal data collected for the purposes of this study will be held for 5 years from the date of publication of the research or presentation of the results to the sponsor, whichever is later/ 1 year after the award of the degree. Although published research outputs are anonymised, we need to retain underlying data collected for the study in a non-anonymised form for a certain period to enable the research to be audited and/or to enable the research findings to be verified.

Contact for further information

If you have any questions or would like further information, please contact:
Denyse King (Principle Investigator)
Midwifery Lecturer / Public Health Practitioner, Bournemouth University
Faculty of Health and Social Care, Midwifery Education
4th floor, St Mary's Community Health Campus
Milton Road, Portsmouth, Hampshire, PO3 6AD
dking@bournemouth.ac.uk, 01202 9 68311

In case of complaints
Any concerns about the study should be directed to Dr. Isabella Rega: IRega@bournemouth.ac.uk. If your concerns have not been answered by Dr. Rega, you should contact Prof. Iain Macrury, DDRPP FMC, Bournemouth University by email to researchgovernance@bournemouth.ac.uk.

Appendix 10 continued: Participant agreement form

![Bournemouth University logo] **Participant Agreement Form**

Full title of project: Collaborative Immersive Virtual Reality Series (CILVRS) - Virtual Reality Learning Environments for healthcare students and healthcare professionals

Name, position and contact details of researcher: Denyse King – Lecturer in midwifery and public health practitioner: dking@bournemouth.ac.uk

Name, position and contact details of supervisor: Dr. Isabella Rega - CEMPDOC lecturer: IRega@bournemouth.ac.uk

PART A

In this Form we ask you to confirm whether you agree to take part in the Project
You should only agree to take part in the Project if you understand what this will mean for you. If you complete the rest of this Form, you will be confirming to us that:

- You have read and understood the Project Participant Information Sheet (CILVRS Healthcare Virtual Reality Learning Environment 1) and have been given access to the BU Research Participant Privacy Notice which sets out how we collect and use personal information (https://www1.bournemouth.ac.uk/about/governance/access-information/data-protection-privacy)

- You have had the opportunity to ask questions;

- You understand that:
  o Taking part in the research will include completing a pre-use and post-use survey, use of a virtual reality learning environment and being recorded (audio and video) during the end of project focus group. These audio recordings will be deleted once transcribed
  o Your participation is voluntary. You can stop participating in research activities at any time without giving a reason, and you are free to decline to answer any particular question(s).
  o If you withdraw from participating in the Project, you may not always be able to withdraw all of your data from further use within the Project, particularly once we have anonymised your data and we can no longer identify you.
  o Data you provide may be included in an anonymised form within a dataset to be archived at BU's Online Research Data Repository.
  o Data you provide may be used in an anonymised form by the research team to support other research projects in the future, including future publications, reports or presentations.

Consent to take part in the Project	*Yes*	*No*
I agree to take part in the Project on the basis set out above	☐	☐

email address   Name of Participant   Date   Signature

Denyse King_____   _____
_____Name of Researcher   Signature   Date

Appendix 11: one page excerpt of the storyboards for the safeguarding VRLE (phase one – this research project) and postpartum haemorrhage VRLE (phase one, branch)

One page excerpt from Melser VRLE story board (Jake) (phase one – this research project)

MCQ4: You're here to provide maternity care, do you change the subject?

MCA4.1 – No, don't change the subject.

MCA4.1.1 Correct – If you keep him talking then you will be able to keep an eye on him until the adult in the house makes an appearance. Interesting that he says his father is encouraging him to truant. Perhaps you need to find out more about why Jake is frequently reluctant to go to school.

MCA 4.2 – Yes, change the subject.

MCA4.2.2 Incorrect – Safeguarding children is everyone's responsibility. No matter where you work, you are likely to encounter children during the course of your normal working activities. You are in a unique position to be able to observe signs of abuse or neglect, or changes in behaviour which may indicate a child may be being abused or neglected.

Gut instinct trigger: Should his mum react the same to the teacher complaining about his behavior as to the police bringing him home? Why is Jake more worried about his mum's reaction than his dad's?

Alarm bell trigger: Police involvement? Is this child already known to MASH / Social Services?

You: "What is it you don't enjoy about class time? Maybe your teacher could help you?"
Jake: "Hah, NOT! Miss says I'm really good at maths and PE but says I don't pay attention long enufs and that's why she gives me telling offs."
You: "Do you know why you are not paying attention for as long as the teacher wants?"
Jake: "Dunno. Sometimes too tired, sometimes bored. Miss says she's gonna hafta have a word with mum and dad if I don't buck up my idears. Hope not 'cos mum'll go spare like she did when the police bringed me home last time."

MCQ5: Do you leave while the going is good or stay to find out more?

MCA5.1 – No, stay and try to find out more.

MCA5.1.1 Correct – It's not your job to investigate safeguarding concerns but you could use some more information to clarify what Jake is telling you before you decide if you are going to contact MASH or not.

MCA 5.2 – Yes, this conversation is nothing to do with maternity care so it's time to leave.

MCA4.2.2 Incorrect – You need to know more about this, and you still need to confirm he isn't alone.

Alarm bell trigger: Young children out on own after dark, near water. Could this be neglect?

Gut instinct trigger: Threatening language used. Could this be emotional abuse? wen parenting.

You: "The police brought you home?"
Jake: "Yeah, in the meat wagon!"
You: "How come you got to ride in the police van?"
Jake: "It's next door's fault really. They was complain'in about the noise me and my mates were making so we walked to the beach."
You: *nod head*
Jake: "The it got dark and we had no bus fare, cops saw us and bringed us home. Mum went spare even though the cops said we wasn't in trouble."
You: "it's dangerous to be out after dark on your own, and extra dangerous to be near the water after dark."
Jake: "Yeah, reckon so…Mum said cops'll lock me up next time."

One page excerpt from Melser VRLE story board (Rosin) (phase one – this research project)

You: "He did say he likes wrestling."
Rosin: "And then he's all craecrae and trying to practise all the moves. So it's really late when he calms down unless he gets told off."
You: "Does he settle when he gets told off?"
Rosin: "No! Then he's cross and sulk'in and kick'in the wall insteada sleeping. Then there's more shouting from mum and dad at Jake or each other."
You: "No wonder he is tired in the mornings. Do you manage to get a good sleep?"
Rosin: "Nah, and if I spend the night here then I can't hang around and see him off to school on time anyway 'cos I gotta leave before he does."

MCA13.1 This is a concern.

MCA13.1.1 Correct, there are several potential concerns here. Do Rosin's parents know she sometimes sleeps elsewhere and do they know where? Is there more to this than just frustration with Jake / with her parents shouting at each other? Does Jake struggle to settle because his parents shout at each other?

MCQ13 The parents shout at Jake and each other. Rosin seems to be implying she doesn't always sleep at home. Are you concerned?

MCA13.2 This is not a concern. Rosin seems quite relaxed about it all. Rosin must be sleeping at a relative's home when she needs a bit of peace and quiet.

MCA13.2.2 Incorrect. Rosin may not be showing how she truly feels about having to leave her home to sleep / escape her parent's arguments.

You: "If? Do you sleep somewhere else?"
Rosin: "Leonie's mum says I can stay round theirs whenever I want and I do….as long as it's not when her cousin's there cos he's a twat and comes in and tickles us when we're already asleep.
You: "Does Leonie's mum know that he does this?"
Rosin: "Leonie's told her. He's forgiven at the moment 'cos he's given me his old iPhone 'cos he got a new one.
You: "He gave you a phone for free?"
Rosin: *goes into kitchen and shouts answer from there* "You ain't half nosey! He tried to trade it for a kiss but I said no chance. He called me a tease and said he doesn't give up easy. Whatever! I've got the phone and even free calls and texts 'cos he's gotta pay until the contract ends. Total win."

One page excerpt from Melser VRLE story board (Fiona) (phase one – this research project)

You: "Do things happen when you're drinking that you feel out of control, uncomfortable or unhappy about?"
Fiona: "No! well except when I hit Steve last time. It left a mark and I feel bad about that, but he's gotta learn he can't push me round. I'll always fight back."
You: "In what way do you feel he has pushed you around?
Fiona: *shrugs shoulders* "Not sure what you're asking."
You: "Does he treat you badly, shout at you, act cruelly emotionally or physically, force sex on you?"
Fiona: "Nah, nothing like that. He pisses me off when he sods off out for a drink without me though. Who knows what else he's getting up to while out drinking? He says I turn into a green-eyed monster, cheeky git! Ooooh just thinking about it makes me feel punchy!"

MCA5.1: Yes.

MCA5.1.1: Correct. It was wrong of Fiona to use physical force to make her point. You will need more info about this matter to determine what kind of help Fiona and Steve may wish to have / need.

MCQ5: Fiona has disclosed that she has hit her husband at least once. Are you concerned?

MCA5.2: No, he's a man and can take care of himself.

MCA5.2.2: Incorrect. The fact that he is a man should make no difference to whether you are concerned about a person who may be enduring physical abuse.

MCA5.3: Maybe, I need more info to decide.

MCA5.3.3: Any disclosure of abuse should cause you concern, regardless of the age or sex of the abuser / abused. You are correct that you will need more info about this matter to determine what kind of help Fiona and Steve may wish to have / need.

You: "Do you find it difficult to control your anger?"
Fiona: "Nah! Well not with the kids but yeah, sometimes with Steve. He's a big man though, you don't gotta worry about him."
"What you've just said about the kids reminds me I wanted to ask you about Rosin sleeping over at her friend Leonie's. She's says it's because she has trouble sleeping here when Jake's been watching wrestling. Do you think she does it more than other kids her age?"
Fiona: "See? There she goes blaming Jake again! We've told her she's to pack that in and I've had a falling out with Sheena anyway so there'll be no more sleeping over there."
You: "These houses do have thin walls, and people Rosin's age tend to have a lot on their minds….perhaps she's trying to tell you something but doesn't know how to?"
Fiona: "Sounds to me like you're telling me you're trying to interfere like everyone else!"

One page excerpt from Melser VRLE story board (Steve) (phase one – this research project)

MCQ2: Steve is making excuses for Fiona's behaviour. Is there any point carrying on with this discussion?

MCA2.1: No. He's clearly in denial.

MCA 2.1.1: Incorrect. He may not be in denial but just in a rut of his coping mechanism. He needs to hear that someone is listening and that he can be signposted to services that can offer help. Not only is Steve at risk but the children will also be adversely affected by their mother physically abusing their father, and may be suffering abuse themselves.

MCA2.2: Yes. He's admitted he's suffering physical abuse.

MCA2.2.2: Correct. Not only is Steve at risk but the children will also be adversely affected by their mother physically abusing their father, and may be suffering abuse themselves. He needs to hear that someone is listening and that he can be signposted to services that can offer help.

Alarm bell trigger: Steve is making excuses for Fiona's behaviour.

Gut instinct trigger: Steve is starting to withdraw from the conversation.

You: "It's not right that you are being hurt by someone you love, no matter the reason. Does she ever hit the children?"
Steve: "No! Just me, sometimes. Fi would never hurt the children."
You: "She doesn't have to hit them to hurt them. If your children are aware Fiona is hitting you that can have a negative impact on them."
Steve: "Like what?"
You: "They might have trouble sleeping, may wet themselves, may be aggressive, have problems at school or not attend school, they may be neglected in certain ways…"
Steve: "Hmmmmm."
You: "I noticed a few of those types of behaviours while I've been here today. Jake could do with a bath and a clothes wash, and some help using up all his energy. Rosin has mentioned trouble with sleeping and other things."
Steve: *buries head in hands*

MCQ3: You notice Steve is starting to withdraw from the discussion. He's admitted there are problems between him and Fiona. Giving him the domestic abuse helpline number and stop before you lose him completely?

MCA3.1: Show him you respect his choice by accepting his need to stop this line of discussion.

MCA3.1.1: Incorrect. He hasn't changed the subject or asked you to stop. He may be building up strength to tell you something else. If you stop without him asking you to you may miss out on further information. Try giving him some positive reinforcement instead of stopping.

MCA3.2: Show him you respect his ability to voice his decisions by carrying on.

MCA3.2.2: Correct. He hasn't changed the subject or asked you to stop. He may be taking a few moments to process what you've just said about the children. Try giving him some positive reinforcement.

You: "Please don't take this as a criticism, everyone needs help from time to time. Good parents recognise that and ask for help."
Steve: "Our life is pretty rubbish at the moment and me and Fi are both feeling down. It doesn't help that she's gone and got herself knocked up again!"
Fiona: *from kitchen* "Oi! I can hear you y'know!"
Steve: *raises voice* "Just joking babes!"
You: "This is a confidential number you can call to chat about Fiona hitting you. Perhaps it would also be a good idea to see your GP to explain that you're feeling a bit low, and see what help you can get with that?"
Steve: *nods* I feel a bit of a fool getting bashed by my wife."
You: "I promise no one who answers that phone number will judge you, and neither would your GP."

One page excerpt from the Parvell family storyboard (phase one – this research project)

Note to developers:
At this point in the scenario the husband should return home. Please have him enter the room and walk over to where Natalie Parvell and the HV are sitting.

Martin Parvell: "I could get used to half days. Much needed today, mind. An early start after a late night is not good fun."
Natalie Parvell: "Poor you. Still you can relax now you're home."
Martin Parvell: "Come to discharge us have you?"
You: "Hello, I'm your health visitor. I've come to do your new baby visit."
Martin Parvell: "Nats, I've invited some colleagues for dinner. 7pm, three courses, nothing too extravagant."
Natalie Parvell: "Of course darling. I'll have a think about what I can pull together."
Martin Parvell: *kicks feet of sleeping man* "Wakey, wakey! We've got a 1pm tee off at the club."

Note for developers:
Martin Parvell should sit on the couch once Natalie's brother makes space.
Both men should remain in the room while the student's avatar is there.

Natalie Parvell: "You both look exhausted. I'll make you an expresso and a bite to eat for lunch shall I?"
Martin Parvell: "Good idea Nats. I can always count on you."
You: "I'll do the baby check now you've finished your cuddle."
Natalie Parvell: "I've already explained that I don't want Evie woken. You can ask us whatever it is you need to know anyway. Here Martin, you hold Evie, she'll stay settled if she's snuggling with her daddy."
You: "I really do need to do a hands-on check prior to discharge. This is routine practice for all babies."
Martin Parvell: "Nats, I'm sure it's possible to do a baby check without waking Evie."
Natalie Parvell: "Of course darling, you know best."
Martin Parvell to you: "I'm sure I don't need to tell you to use your lightest touch?"

Alarm bell trigger:
Infants who have yet to acquire independent mobility (rolling/crawling) should not have bruises without a clear explanation.

Note for developers:
The healthcare worker will set up equipment including a mat to do the baby check on. When Martin Parvell places the baby on the mat her eyes should open. It should be clear that the whites of the baby's eyes are red like the photo on the VRLE design list. This should also trigger the alarm bell info.

One page of the Postpartum Haemorrhage (PPH) VRLE storyboard
(phase one, branch)

Note to developers:
There should now be four clinicians in the room as well as with the parents and baby. One clinician can be busy doing something at the side of the bed / to the mother, one should be beside the bed facing the mother and two can be doing something off to the side such as gathering / looking at equipment.

Insert the PPH proforma at this point.

The avatar signals a need for the PPH box here.

MCA4.1 Assessment of situation including maternal observations, uterine tone, estimation of blood loss, level of consciousness.

MCA4.1.1 Incorrect. This is not enough action at this stage and will lead to deterioration of Jessica's clinical condition. Her PV loss will continue to increase so the lack of homeostasis and oxytocic medications need to be addressed urgently.

MCA4: As the lead for this emergency, what actions do you want the newly assembled team (including you) to do next?

MCA4.2 Take actions to identify the cause of, and stop, the bleeding. Ensure any other clinical needs are being addressed.

MCA4.2.2 Correct. This would include examination of the placenta, identifying and resolving atony, trauma and coagulation issues, as well as catheterization and ongoing basic observations of maternal wellbeing. Jessica needs to be laid flat and high flow O2 commenced You may also need to rapidly prepare for first line fluid replacement and drug therapy.

The sphyg should be connected to Jessica and a SATS probe. Images for O2, Hartmann's, catheter, TXA, blood bottles, Oxytocics here.

MCA4.3 Commence first line drug therapy (IV tranexamic acid) and rapid crystalloid fluid replacement, determine cause of blood loss.

MCA4.3.3 Partially correct. This step includes achieving prophylactic IV access through two large bore cannulas, taking blood samples (FBC, clotting screen, group and cross match, preparing to replace fluids rapidly with two liters of crystalloid. However, you must also urgently identify and stop the cause of bleeding.

Note to developers:
One clinician needs to be facing the mother with a hand on her abdomen. The mother should be lying flat on the bed and have an oxygen mask on. The bed should be flat, ideally with the head of the bed lower than the foot of the bed.

Prompt for students: It is now 6 – 9 minutes since you entered the room. Jessica's PPH has not yet been resolved and she continues to bleed. There is now an obstetrician present as part of the team caring for Jessica.

Appendix 12: participant information for downloading and accessing the safeguarding VRLEs

- **How to download and enter the VRLE app**
    - To install the app for mobile devices, open the Play/App Store and search for Fieldscapes
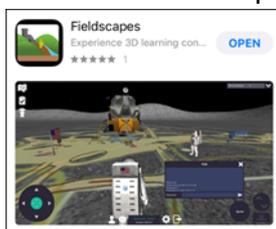
    - To install on a computer visit https://live.fieldscapesvr.com/Home/Download and download the appropriate option.


    - To access the VRLE for the first time please use your university email address and the password you were allocated as part of the research enrolment. Please change your password after logging in for the first time.
- **Ways the VRLE can be experienced**
    - You can use the VRLE on laptops, PC or Mac, iPad / tablet, your smart phone and other mobile devices (with or without a headset). If you are wishing to use a headset then you need to switch the Fieldscapes app to 3D by choosing this option from the drop down menu on the upper left.
- **Where to find the VRLE on Fieldscapes**
    - You will find this in your exercises / assignments tab on the Fieldscapes menu. The appropriate scenario will listed under the 'My Assignments' tab.
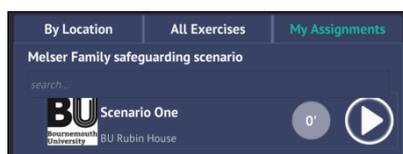
    Press the Play arrow icon to launch.

    Note: The scenarios may take a moment to load.

- **Navigation**
    - On mobile devices, navigate using the compass icon bottom left of the screen, select objects or options using the touch screen
    - On computers, navigate using the arrow keys, select objects or options by clicking.
    - To exit, click the Door/Arrow icon bottom right of the screen.

Can I walk around or am I stuck in one spot?

- o You can move the dialogue boxes aside and walk around the homes. Take time to look around inside the homes because this is as important as talking to the families

This document was created by Denyse King for teaching and research purposes only and any resemblance to real life persons is unintended.

Moonbeam Maternity Unit
Moonbeam NHS Hospital Trust
Moonbeam Road
Moonbeam
Moonland

MATERNITY NOTES

Birth summary

Maternal information:

Name	Natalie Parvell
Address	The Gables, Midnight Mews, Moonbeam MG11 6XY
Hospital number	MB 984762

Past History:

Medical history	Nil
Past obstetric history	G2P2
Family history	Nil of note
Social history	Married. Husband is a Respiratory Consultant.

This Pregnancy:

Comments	AN depression. Sertraline 100mg od.

Birth:

Date	00/00/00
Time	17.40
Gestation	39/40
Mode of delivery	Normal birth
Drugs in labour	Entonox and epidural
Blood loss	450mls
Perineal trauma	1st degree tear; not sutured
1st stage	1 hour 40 minutes
2nd stage	0 hour 21 minutes
3rd stage	5 minutes
Total time	2 hours 06 minutes

Birth attendants	RM D. Faith STMW G. Perry
Comments	Membranes ruptured: at 22:36 on 00/00/00 Advised re: perineal hygiene

Baby:

Sex	FI		
Birth weight	4.1 kg	Apgar at 1 minute	7
Meconium	No	Apgar at 5 minute	9
Fetal distress	Yes	Initial temperature	37.0 ºC
Resuscitation	None required	Vitamin K	1mg given IM

Initial check	Rapid birth. No apparent abnormalities

Comments	Skin to skin with mother + breastfed at birth Maternal Observations: Temp 37.1 B/P 110/60 Pulse 92 RR 20

Signed *D. Faith* (D. Faith) RM

Date and time 00/00/00 19.10 hrs

Date	Natalie Parvell MB 984762	signature
00/00/00 *22:00*	*Baby still skin to skin following birth. PV loss minimal, all other observations stable. Initial neonatal check satisfactory; 4 hourly withdrawal obs commenced (maternal medication). Natalie and baby to be transferred to the postnatal ward as soon as Natalie ready as labour ward busy.*	*P. Smith RM*
00/00/00 *22:20*	*Natalie and baby transferred to the postnatal ward. Natalie wants to sleep. Observations – no change. Will recheck in morning,*	*M. Davis RM*
00/00/00 *08:00*	*Care taken over by day staff. Natalie reports that baby fed well overnight. Has passed urine and meconium. Withdrawal obs score 0 overnight for baby.*	*F.Bradley RM*
	Uterus firm, and well contracted, lochia minimal. Perineum clean and healing. Maternal pulse 75 bpm, 120 / 65, Temp 36.5 Resps 19.	*F.Bradley RM*
12:00	*Natalie gently mobilising. Experiencing some perineal pain, advice and regular analgesia given. Has passed 350 mls clear urine.*	*F.Bradley RM*
14:00	*Maternal observations pulse 80bpm, BP 120 / 64, Temp 37. Natalie asked for formula milk as too tired to breastfeed now.*	*D.Potter RM*

20:00	*Care handed to night staff, mum and baby settled for evening, aware to ask for help if required. Natalie asking to go home tomorrow.*	*F.Bradley RM*
00/00/00 11:00	*Baby seen by paediatrician; fit for discharge – withdrawal obs NAD. Natalie feels well other than perineal discomfort, lochia within normal limits, pulse 85bpm, BP 122 / 66, Temp 36.6 Resps. 19. Mum and baby discharged home, mixed feeding.*	*T. Star RM*
00/00/00 12:00	*Seen at home for postnatal check. Natalie looks tired – did not breastfeed overnight as too tired – reports partner gave baby bottle feeds overnight. Baby put to breast and fed well. Temp 37.3, BP 118/ 60, P80, resps 18. Advised to rest and ensure good nutrition and hydration. Review at clinic for NBBS testing.*	*M Davis RM*
00/00/00 11:15	*Natalie DNAd today's community clinic appointment. Contacted by phone. She says she feels very tired today, and feels a bit achy all over. Advised to rest. Home visit tomorrow 10:00 for NBBS test and baby weight. Mixed feeding 2 – 3 hours. No other concerns – says she has support at home.*	*F. White RM*
00/00/00 16:00	*Home visit time of 10:00 rescheduled to now as Natalie was asleep and did not hear bell. Natalie says she is tired and feeling low. She will see GP. Lochia minimal, declined perineum check. Breasts comfy.* *Baby weight 3.69kg (10% weight loss) – mixed feeding 2 – 3 hourly. Advised. Cord clean and dry. Lots of wet and dirty nappies, yellow stools. NBBS taken with consent. Discharge visit planned for day 14. To call if any problems, aware of numbers.*	*P. Lilley RM*

Appendix 14: Intro for the urinalysis concept testing (phase zero)

VRLE in a community hospital setting

Thank you for agreeing to take part in this concept testing pilot.

Welcome to your urinalysis practical skills session which takes place in the virtual reality learning environment (VRLE) in a community hospital.

You should expect this to take approximately 10 minutes to complete.

You can test your skills in this practical as many times as you like, but if you have not already gone through the tutorial then you are advised to do so prior to entering the VRLE.

When you begin you will find your avatar sat at the desk in the midwifery clinic room prepping for the next client on the appointment list – Ms Sumi Smith – who knows you are a student midwife.

Ms Sumi Smith will arrive in 15 – 20 seconds after you enter the VRLE so feel free to use your spare time to look around the room and to touch things on the desk or elsewhere in the room.

Take your time testing your skills and enjoy your learning – no one except you will know if you make mistakes, and if you do then just keep practising urinalysis here until you stop making them.

Appendix 15: additional VRLE suggested by the concept testing (phase zero) students

Drugs calculations and management.

Antenatal appointments and labour and birth.

Venepuncture

An entire antenatal/postnatal appointment with various questions from the mother ie breastfeeding

Although not practical, familiarising myself with setting up to catheterise.

Post birth baby and placenta checks?

Blood pressures, palpation.

All clinical skills, palpitation would be great but I've no idea how it would work

A full antenatal appointment including documentation.

Labour in different circumstances.

More clinical skills

Explaining screening.

Venapuncture, blood pressure, recording documents

Venepuncture

Palpation

Any kind of appointment and the order in which to do everything during that appointment

- different types of injections (angles in which to insert/ whether to pinch or apply pressure to skin), enabling to learn the differences between types of injections

Venepuncture, catheterisation

Each skill needed for clinic

Complex things and situations that require knowledge to make decisions

Palpation, bloods, and all clinical things.

Practicing antenatal appointments.

something a bit more practical like catheterisation

Antenatal appointments and breastfeeding would be very helpful

Glossary of commonly used words, their acronym and definition

Term	Acronym	Definition
Active Worlds Educational Universe	AWEU	Virtual world for education created by Activeworlds Inc.: https://www.activeworlds.com/
Alternate or extended reality	AER	Any application that takes the user somewhere other than the traditional / 'real life' learning environment of a classroom, skills lab or clinical placement.
Artificial Intelligence	AI	Intelligent machines currently (2023) capable of pattern recognition, generating text, problem solving and tasks like operating machinery.
Asynchronicity	None	Experiencing the VR as an individual without real time co-learning
Avatar	None	An avatar is a representation of the user in the virtual world.
Avatar with agency	AWA	An avatar which is more than just an icon and can move about the virtual space, talking and undertaking tasks.
Bournemouth University	BU	My employer
Compassion in Practice	6 Cs	Healthcare values framework comprised of the following key aspects: care, compassion, competence, communication, courage and commitment.
Continuous Professional Development	CPD	Ongoing learning post qualification in order to maintain professional registration and to keep skills current.
Confidence Interval	CI	Give boundaries to the margin of error and allows inferences to be made in relation to the RPs data compared to the general healthcare student population (Smith 2023).
Daden Ltd.		A specialist VR education company that built the VRLEs designed for BU healthcare students: https://www.daden.co.uk/
Department of Health and Social Care	DHSC	DHSC is a ministerial department, supported by 24 agencies and public bodies who lead the nation's health and social care to help people live more independent, healthier lives for longer (Gov.uk 2023).
Europe	EU	
Face to Face	F2F	In person education that is not situated in a virtual classroom.

Term	Acronym	Definition
Head Mounted Display	HMD	A head-mounted and hand free device which allows people to fully immerse in the virtual space
Health Education England	HEE	Also includes NHS Digital and NHS England. Responsible for ensuring healthcare education is suitable for the future workforce needs.
Health and Care Professions Council	HCPC	Regulator and register of 15 different professions in the UK including paramedics and physiotherapists. They also approve the education programmes.
Higher Education	HE	Offer education from undergraduate degree level and up
High Fidelity Simulation mannikins	HFSM	Use of a computer-based lifelike mannequin in a realistic patient environment such as a university clinical skills lab to allow experiential training of skills, knowledge, and decision-making.
International Confederation of Midwives	ICM	ICM is an accredited non-governmental organisation representing midwives and midwifery to organisations worldwide to achieve common goals in the care of mothers and newborns. 140 member associations from 119 countries which represent more than 1 million midwives (ICM 2023).
International Council of Nurses	ICN	Worldwide representative of nursing which aims to promotes advancement of the nursing profession.
Inter-reality / mixed reality	IR / MR	A hybrid of two worlds (the real world and a virtual world) and the integration of user's experiences in them.
Island	None	Location inside Second Life.
Linden Labs	LL	Company that created the virtual world known as Second Life.
Nursing and Midwifery Council	NMC	Regulator and register of all qualified ad registered nurses, midwives and nursing and midwifery teachers within the UK. They also approve the education programmes.
Maternal and Childhood Obesity	MaCO	Standalone distance learning unit for all healthcare students and professionals which now incorporates care for men and the elderly as well as women and children.
Term	Acronym	Definition

Term	Acronym	Definition
Online Interactive Virtual Environment	OLIVE	Virtual world for education created by SAIC
Participant Agreement Form	PA	Students choosing to take part in the research after reading the PI form needed to indicate their consent using this form.
Participant Information Form	PI	Students interested in this research were given this form to read which had more detailed information than the preliminary information they were given about the research.
Personal Tutor	PT	A named member of the teaching team allocated to support of a group of healthcare students for the three years of their degree.
Postpartum Haemorrhage	PPH	A blood loss after giving birth which is usually more than 500mls but can be a smaller amount if it adversely compromises the health of the woman.
Randomised Controlled Trial	RCT	Research that randomly assigns participants to either a control group or the action group.
Research Participants	RP	People who consent to participate in research.
Second Life	SL	A virtual world created by LL: www.secondlife.com
Small and medium-sized enterprises	SME	Any business with fewer than 250 employees and earning less than 50 million each year (Gov.uk 2020).
Statistical Package for Social Sciences	SPSS	Offers various options for use when analysing quantitative data.
Synchronicity	None	Experiencing the VR as an individual within a group of other avatars in real time co-learning
Technology Enhanced Learning	TEL	Technological enhancements for learning from classroom based smart boards to digital learning tools such as discussion boards to virtual learning environments such as virtual classrooms.
Virbela Open Campus	VBO	Space to collaborate, share and learn.
Virtual Learning Environment	VLE	Virtual learning environment - a software system designed to support teaching and learning in an educational setting
Virtual Reality	VR	An partly or fully immersive and interactive simulation of either reality-based or imaginary / fantasy images and scenes.
Term	Acronym	Definition
Virtual world	VW	A synchronous, persistent network of people, represented as avatars.

		Virtual worlds have their own unique cultural expectations and norms which can be vastly different to those in real life. The user may experience stages of engagement, engrossment and total immersion.
Virtual Reality Learning Environment	VRLE	A designed environment where students are represented as avatars and can experience a/synchronous virtual learning and application of theory to clinical practice.
World Health Organization	WHO	Monitor and work to improve world health based in Geneva but comprised of 194 member states