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Radiography 28 (2022) 577–585

Contents lists available at ScienceDirect

Radiography

journal homepage: www.elsevier.com/locate/radi

First year student radiographers' perceptions of a one-week simulation-based education package designed to increase clinical placement capacity

A. Partner, N. Shiner*, E. Hyde, S. Errett

College of Health, Psychology & Social Care, University of DerbyKedleston Road Derby DE22 1GB, UK

ARTICLE INFO

Article history:
Received 2 July 2021
Received in revised form
6 April 2022
Accepted 13 April 2022
Available online 27 April 2022

Keywords:
Simulation
Radiography
Placement capacity
Clinical hours
Education

ABSTRACT

Introduction: The radiography workforce is short-staffed and under increasing pressure to meet service pressures. Combined with the impact of Covid-19, where student face-to-face clinical time was abruptly halted for safety, there is cause to change the pedagogical approach to teaching diagnostic radiography to students, increasing capacity and ensuring the continuance of qualifying radiographers to support the profession. This paper shares the perceptions of first year student radiographers on a one-week simulation-based education package designed to replace one week of clinical placement experience.

Methods: Two cohorts of first-year radiography students engaged in a one-week simulation-based education package. Simulations increased in complexity throughout the week and included conventional imaging techniques, mobile and theatre radiography, and cross-sectional imaging. Thirty-six students consented to the thematic analysis of their reflective blogs.

Results: Five themes emerged from the data: feeling anxious, understanding and skill development, building confidence, communication, and patient-centred care.

Conclusion: The simulation package had a positive impact on students learning, no matter the stage at which it was incorporated into their clinical placement block. Students engaged well with the activities and saw value in the experience. The findings indicate that the simulation-based education package is a suitable replacement for one week of clinical placement, supporting skills development in students and providing increased placement capacity.

Implications for practice: A successful, engaging simulation-based education package is presented, which first year student radiographers perceived as a suitable replacement for one-week of clinical placement. Further research into the acceptability of use of simulation-based education packages in second- and third-year student radiographers would be a useful next step.

Introduction

Clinical placements are regarded as the 'gold standard' for health care students to gain clinical experience and education within literature.[1] Across Europe, clinical placement is a core component of the curriculum to support student radiographer education.[2]

Recent media attention has highlighted the need for an increased workforce to reduce pressures on imaging services in the UK.[3] Following the UK Government's Comprehensive Spending Review in 2015,[4] the cap on health care student numbers was removed, and many UK universities looked at innovative ways of increasing student numbers to meet the needs of the service and to securely run programmes in a competitive market. Clinical placements are limited due to finite equipment, staffing, and space. Several different healthcare professions have used simulation-based education (SBE) as partial replacement for clinical placement hours for several years.[1,5–7] SBE is an established pedagogical approach to delivering health care education.[8] The Health & Care Professions Council[9] and Nursing & Midwifery Council[10] both advocate and provide guidance on the use of SBE. Simulation in medical and healthcare education is a pedagogical activity where students learn from practice-based scenarios which:

* Corresponding author.
E-mail addresses: a.partner@derby.ac.uk (A. Partner), n.shiner@derby.ac.uk (N. Shiner), e.hyde@derby.ac.uk (E. Hyde), s.errett@derby.ac.uk (S. Errett).
(N. Shiner), (E. Hyde)

https://doi.org/10.1016/j.radi.2022.04.007

"Imitate real patients, anatomic regions or clinical tasks, or to mirror the real-life situations in which medical services are rendered."[10]

Research has shown that diagnostic radiography students find it challenging to transition from academia into clinical placement.[11–13] Within imaging placements where ionising radiation is being used, hands-on experience with real patients can be risky,[14] particularly in high-intensity areas, and therefore students may take on an observational role to reduce risk. Simulation can avert risks[15] and provide realistic experience in areas where there are fewer opportunities for direct patient contact.[16]

Simulation has demonstrated that it can lead to better learning of knowledge and skills[17–19] and can positively impact patient outcomes.[18] Often first-year students can be daunted by placement experience and the pace at which workflows; simulation can build students' esteem and self-confidence.[20,21]

Radiography educators are increasing their use of simulation, and it is now regarded a highly suitable tool for the profession.[22,23] High fidelity simulations can support student's emotional preparedness for working with patients with open wounds, burns and other complex needs.[16,24] Other studies have found that simulation can positively effect skills of critical thinking, image evaluation and patient assessment.[23] Simulations should be planned purposefully to ensure set objectives are aligned with the activity, but there should also be flexibility[25] to gain value from unexpected situations or data gathered. A significant aspect of a simulation is the immediate debriefing following the activities which clinical placement doesn't always facilitate.[26,27] The controlled environment that simulation offers allows for learning to take place in universities, reducing the burden on clinical departments.[28]

Bogossian et al.[5] completed a systematic review to locate 'gold standard' evidence for the use of SBE as a replacement for clinical hours. Studies reported either a statistical equivalence recommending SBE or a statistical improvement in knowledge, confidence and satisfaction when it was used to replace clinical placement hours. The impact of COVID-19 meant several UK radiography programmes used SBE to support students continued learning when clinical placements were withdrawn.[29] Furthermore, simulation has been successfully used to replace clinical placement hours within radiotherapy programmes.[30] Despite this evidence it is challenging to ascertain the optimum number of hours to use SBE as a replacement, with recommendations in the literature varying from around 20 h up to two years.[5] It was key to ensure students were familiar with SBE prior to making key changes to the curriculum design. Simulation was initially introduced into the programme to replace didactic lectures on clinical themes and to enrich practical sessions in the x-ray room. This has evolved to enhance placement in line with Health Education England's expectation that students can make the best possible use of the available workplace time.[31]

It is recognised that strong evidence is required to support this shift in the curriculum; a dominance in quantitative studies to evaluate the use of SBE was found across literature reviews.[1,5] However, SBE requires student engagement to be successful.[22] Therefore gaining student perception of the use of SBE to increase their placement capacity is considered equally valuable to the evidence base. This research evaluates first year radiography student perceptions of the integration of a simulation week into the clinical placement block, replacing 30 clinical placement hours, using high fidelity scenarios mirroring real-life clinical settings.

Methods

The design and structure of the simulation-based education package

The simulation-based education package being evaluated in this research was designed by one of the co-authors (Naomi Shiner). A framework consistent with the National Health Education and Training in Simulation (NHET-Sim) programme in Australia was utilised: preparing, briefing, simulation activity, debriefing, reflecting and feedback, and evaluating.[25,32] Instructions, pre-sessional activities and a timetable for the week were posted on the students' virtual learning environment (VLE), so they were sufficiently briefed and understood what would be expected of them during the week. Students were familiar with the VLE and the environment in which the simulations would take place, having already completed semester one. This level of pre-briefing was designed to reduce their extraneous load, which would impair learning.[33]

First-year student radiographers were released from clinical placement in small groups (n = 6–9) to participate in the week-long, mandatory simulation package instead of clinical placement. Over a seven-week period, each student would have one thirty-hour week of simulation built into their clinical rota. Multiple simulation activities were developed to align with the students' learning outcomes for their first clinical placement (Table 1). Further detail on the simulation package can be found in Fig. 1, each simulation activity had its own learning outcome, an example of which are provided in Fig. 2. All the simulation activities were undertaken as groups with specific tasks and roles taken on individually.

Table 1
Simulation activities.

Day and room	Activity - morning	Activity - afternoon
Monday	**Pre-sessional reading**	**Online learning and blog preparation**
Self -Study	Directed by VLE	WordPress
Tuesday	**Accident & Emergency (A&E) radiographic technique**	**Radiographic technique**
X-ray room	Patient 1 – Elbow x-ray A&E referral	Patient 1 – Inpatient referral Chest x-ray
	Patient 2 – Ankle/Knee x-ray A&E referral	Patient 2 – Fracture clinic referral Wrist x-ray
	Patient 3 – Abdomen x-ray A&E referral	Patient 3 – GP referral Knee x-ray
Wednesday	**Theatre radiography**	**Shaderware – Chest image evaluation**
Theatre	Patient 1 – Manipulation Under Anaesthetics	Revisit the inpatient scenario from day before.
Computer labs	Patient 2 – Facet joint injections	
Thursday	**Mobile chest radiography**	**CT/MRI software**
Ward	Patient 1 – Communication skills	CT/MRI Head, Chest, Pelvis and Abdomen
Computer lab	Patient 2 – Naso Gastric Tube Unwell relative/patients	
	Patient 3 – Patient soils the bed.	
Friday	**Reflection**	**Reflection**
Self-study	Write a blog post reflecting on the week	Consolidation of thoughts with a SMART Action plan

- ❑ Runs over 7 weeks in the second semester (January-February) during the first year clinical placement block
- ❑ Each student will have a 30hr simulation week built into their clinical roster
- ❑ 6-9 students in each group
- ❑ Group is a mix from the 3 clinical rotations to increase capacity across the placements and share learning from different sites.
- ❑ 1 academic facilitator per simulation activity
- ❑ Each Simulation Activity is/has:
  - 3hrs long
  - Session aim
  - Designed set of learning objectives
  - A Situation, Background, Assessment, Recommendation (SBAR)
  - Specified equipment
  - A student brief
  - Clinical information and history
  - Role descriptors and guidance
  - Students observing using the observational sheet
  - A Debrief

Figure 1. Simulation package details.

Learning objectives:	**1) Understand patient pathway** **2) Undertake appropriate radiographic technique** **3) Communicate with the patient and radiographer** **4) Critique the image** **5) Articulate the patients expected pathway from radiology.**

Figure 2. Example learning outcome from A&E radiographic technique.

The simulation package itself was a blended learning activity with a mixture of resources, including e-learning, role play, simulation software using Shaderware and The Institute for Advanced Clinical Imaging (ACI) CT/MRI package, and high-fidelity simulations using the ward, x-ray, and theatre environments. Patient-centred care was a focus built into all the scenarios and discussed within each debrief. Students gained the perspective of the patient through role play and engaging in tasks such as personal care of the patient. The package had several interventions designed to enhance self-efficacy, including the use of a safe and controlled environment, briefing, repetition, peer support, debriefing including staff and student feedback, and time to reflect.[34,35] Hendry,[36] and Shiner,[34] discuss the need to undertake a scaffolded approach to teaching students, building in complexity allowing for students to shift through the domains of learning; this was applied during the design and delivery of the simulation package by introducing challenges related to patient communication, co-operation and mobility. Staff facilitated each simulation providing additional learning points and maintaining safety. Through debriefing, staff guided students to reach a level of understanding that permitted them to continue to the next level of complexity throughout the week.

All students in each cohort were asked to complete WordPress Blogs to gain the placement hours related to each activity and to record their reflections. This was an informal activity to support self-reflection, as such no academic feedback was provided. Research shows that blogs are a useful qualitative data collection method that captures participants' feelings and perceptions.[37,38] Other researchers have chosen blogs for their qualitative studies as they produce reflective, descriptive, and exploratory content,[39] making blogging an advantageous tool.[38,40] Diary blogs characteristics can be conducive to receiving honest and open experiences of participants.[38]

Ethical approval

In line with standard practice in our institution, ethical approval is not required for evaluation of a new pedagogy. The evaluation was approved by the research gatekeeper, and ethical principles were always followed, including the use of participant information sheets and consent forms. Issues of power and consent were mitigated by ensuring that students were aware that participation in the evaluation was completely optional, and their blogs would be completely anonymised, however it should be acknowledged that the staff–student relationship may have influenced some responses. Data collection followed UK data protection principles.[41,42]

Pilot study

The simulation package was piloted on first-year radiography students (n = 41) in 2018/2019 academic year. All 41 students enrolled on the programme were invited to consent to their reflective blogs being analysed as part of the evaluation of the simulation-based education package. Students were told about the evaluation project before they commenced writing their blogs.

Those who consented (n = 13) had their reflective blogs anonymised and independently thematically analysed by two academics, using a 6-step process as follows; familiarisation, coding, generating themes, reviewing themes, defining, and naming themes and writing up.[43] From this analysis, conclusions were drawn about the successes and shortcomings of the package and its suitability to replace clinical placement hours. The identified themes can be seen in Fig. 3.

The researchers reviewed the pilot study results and following discussion with the academic team delivering the package, and it was felt no changes to the package were necessary. The simulation package was therefore incorporated into the first-year curriculum, permitting further evaluation in 2020. The themes identified in the pilot study were carried through and were used in the full 2020 evaluation.

2020 evaluation

The evaluation of the simulation-based education package was repeated in the 2019/20 academic year. A purposive sampling approach was chosen due to convenience.[43] The entire cohort of first year diagnostic radiography students (n = 60) was invited to participate with no exclusion criteria. This approach allowed evaluation of the simulation package in a timely manner and gave relevant insights in a feasible way.[44]

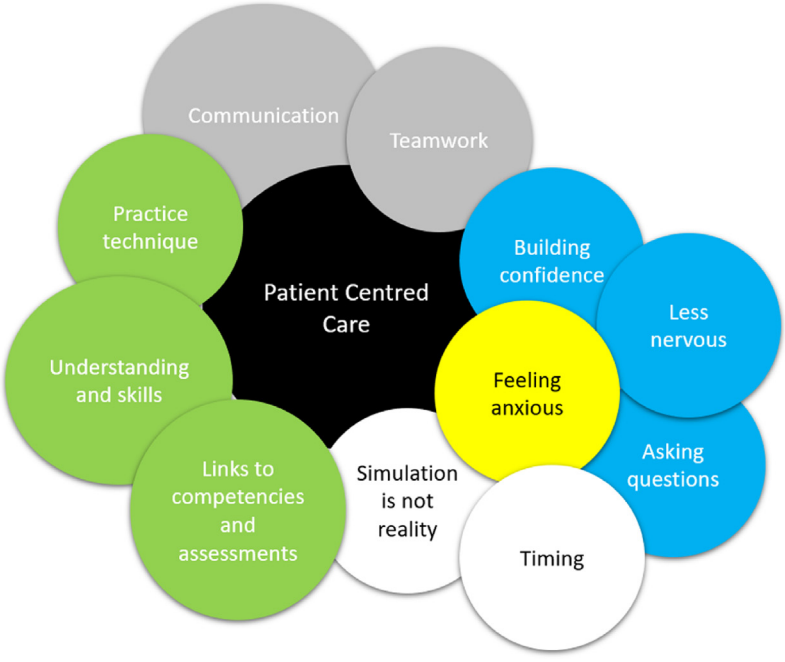
Two researchers independently thematically analysed all of the anonymised blog posts written by students who had consented to take part in the evaluation (n = 23). A third researcher blind sampled several blogs (n = 12) to ensure that the themes identified were consistent and accurate, increasing the rigor and validity of the results. A fourth researcher worked alongside the team to compare a sample across all three sets of codes.

Results

Twenty-three student radiographers were recruited to the evaluation, a response rate of 38%. The blog posts sampled reflected student radiographers' experiences during the simulation-based education package, including their evaluations of the activities, their perceptions of the cases used, their learning experiences and how they thought it would change their future practice. Table 2 demonstrates the overall chronology of the studies and their respective samples.

Discussion

The discussion will be centred around the 5 main themes identified in Fig. 4. Student quotes will be used as supporting evidence, and the relevance will be discussed in the context of existing literature to demonstrate the impact of the simulation package.



Colour	Theme
Green	Understanding and skills development
White	Simulation is not reality
Yellow	Feeling anxious
Blue	Building confidence
Black	Patient-centred care
Grey	Communication

Figure 3. Pilot study themes. Key to pilot study themes in Fig. 3.

Table 2
Chronology and recruitment of respective cohorts.

	Pilot study (2018/19)	2019/20 Evaluation
Timing	Academic year 2018/19 January–February	Academic year 2019/20 January–February
Total Number of students in cohort	41	60
Number consented to blogs being evaluated	13	23
Participation rate	32%	38%
Approach to analysis	Thematic analysis	Thematic analysis

Five themes emerged from the data analysis and are displayed in Fig. 4 along with the subthemes.

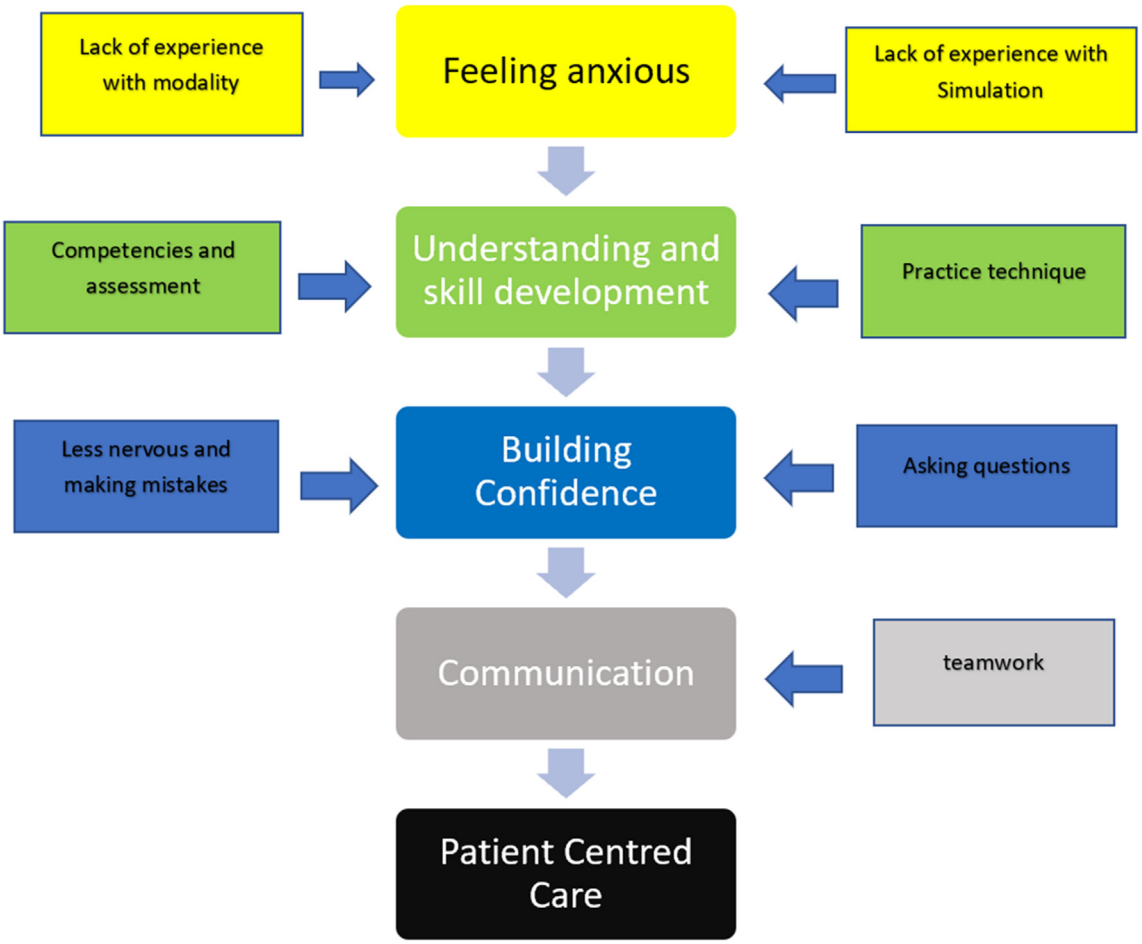


Figure 4. Themes and subthemes.

This will be used to consider the potential for simulated practice to replace traditional clinical placement hours.

Feeling anxious

Student participants reported feeling anxious throughout the simulation-based education package; however, this feeling was noted to reduce over during the week. Student participants discussed anxiety related to the learning experiences, as well as the actual tasks being undertaken. Anxiety is considered an emotion with a negative valence; it can be associated with misinterpreting stimuli such as facial expressions and social situations.[45] Feeling anxious is reported to impair memory recall, potentially resulting in an inappropriate action.[46] Simulation is a safe environment to make mistakes[22]; however, peer and facilitator observation can increase feelings of anxiety as students view the activity as a performance.[47] The student participant below reflects on the impact the simulation had on their future decision making, having clearly made an error in the scenario and feeling anxious about role play.

> *"I find drama/role play very stressful as I am not the most confident person, although I do find that I am more confident in the x-ray department on placement, most probably because they are real people and I don't have multiple people watching me. I know that I will definitely remember to keep the patient in a wheelchair if they do not need to be moved!" SR111*

A lack of experience with the scenario and simulation, was linked to provoking feelings of anxiety in students. This was seen particularly in the theatre and mobile scenarios.

"Mobiles! This was the activity I was dreading the most by far. I haven't had much experience with patients onwards, or the mobile x-ray machines." SR122

This evaluation used a self-reporting methodology, the feelings of anxiety played in the overall student learning experience was interpreted by the researchers. Alternative objective methods using State-Trait-Anxiety-Inventory or Visual Analogue Scales have been used in simulation research, acknowledging that the presence of anxiety during simulated activity is not uncommon.[24,48] It is noteworthy that throughout the week the student participants focus in their reflective blogs notably shifted from feeling anxious to building confidence. The role simulation plays in this shift is discussed under 'Building confidence'.

Understanding and skills development

Student participants noted the benefit of being able to practice radiographic technique during the simulation-based education package, without pressure or fear of being judged, and valued the peer learning opportunities. This was particularly evident in participants' blogs about activities in the x-ray room, undertaking mobile radiography and theatre simulations. Fanning and Gaba[27] acknowledge that on occasion peer judgment can be feared, although it is unclear if additional insight is learned; it is reasonable to argue the shared learning experience supports the affective domain, with students having a greater awareness of each other's emotions during the simulation activities.[16,36]

"It was having good feedback to encourage your strengths from peers, as well as constructive feedback on what to work with." SR116

Student participants reflected upon developing a greater understanding of policy and procedures in department. This included patient safety considerations: manual handling, infection control, and radiation safety, justification of referrals, and working practices in modalities such as CT and MRI.

"… an understanding of what the radiographer is doing when setting up protocols and sequences." SR118

The student participants perceptions following the use of the computer-based simulation support the findings of Chaka and Hardy.[49] Student participants valued the repetition, learning at their own pace, and the functionality of the programme, with inclusion of realistic sound during scanning, adding a level of immersion and transferability to clinical practice.

Several student participants reflected in their blog that having time to discuss topics such as chest x-ray evaluation was useful, and supported them to have a better understanding, reflecting on the transfer of these skills into their future practice.

"It was a very useful exercise … we were able to learn the appearance of a lordotic and kyphotic curve on a spine and how it can affect an image and the problems of having perforations and a patient with pneumothorax. This was fascinating since as an individual I am now able to possibly identify the status of a patient from assessing their previous chest x-rays." SR116

Student participants highlighted how the simulation package helped them to develop team working skills and understand the roles played by members of the imaging team. This will be discussed under the communication theme.

Building confidence

It is established that simulation as a pedagogy has the potential to increase students' confidence in a range of clinical and professional skills.[22,50] Several student participants reported increased confidence at the end of the simulation-based education package, despite their level of prior clinical experience being low due to the position of their simulation week during the placement block.

"… after taking on the role in the second scenario as the student radiographer, I felt much more confident. Certain elements felt natural and I was not having to think if I was doing everything because it just flowed. From this I have learnt that I need to have more confidence within my own ability; this will help me to improve further on my competence during placement." SR120

This is linked to the reduction in feelings of anxiety, as student participants became comfortable with the transformational space. Providing encouragement, anticipation, and rehearsal as key interventions, supported a greater sense of self-efficacy.[35] Furthermore, reflective practice supported students to recognise changes in their confidence, enabling them to change behaviour later in clinical placement.

"I know that I will feel more confidence during my theatre week on placement, and rather than stand at the edge of the room, as far away from anything sterile as possible, I will be able to offer my help to the radiographer." SR118

Repetition with multiple scenarios and computer-based software built confidence with the equipment, promoting muscle memory, and reducing cognitive loading. The simulation offered physical stimuli that is not present with didactic teaching.[51] This enabled greater support to individuals in the room, with improved confidence in communication, patient-centred care, experience with more challenging areas and peer support.

"Overall, today as participants we have all gained confidence in our ability to multi-task and support not only the patient but the student at the same time as a radiographer." SR116

Using cognitive load theory in the design of the simulation package can reduce the load on the students' working memory.[33,34] This was important for students learning new clinical areas such as mobiles or theatre, areas that promoted increased feelings of anxiety. However, even student participants with perceived confidence and greater experience learned from the scenarios.

"I participated in a simulation of mobile chest radiography. This was something I felt confident in as I had performed numerous mobile chest x-ray … I learned that technique was much faster, efficient, and more comfortable for the patients to set the machine up and the place the detector behind the patients back." SR113

The simulation enhanced their confidence, and this was translated into improved communication, discussed below.

Communication

Student participants reflected on how their own communication skills had developed during the simulation-based education package, and they felt they had honed their communication skills further by providing peer feedback. This resulted in them having more awareness of the quality of their communication with patients and other professionals.

"As the scenarios progressed, communication with other professionals on the ward became more natural." SR118

Student participants also highlighted that they had gained understanding about the need to communicate even if patients were unresponsive, an aspect also discussed by Hyde & Strudwick[12] in their research into first year student radiographers experience of working with very ill patients.

"Communication is still very important with a very ill patient." SR144

Student participants reported having a new understanding and appreciation of what it was like to be a patient. Developing a greater consideration for patient dignity and feeling more confident to provide care and compassion than prior to the simulation package. Some student participants reported how their empathy for patients undergoing imaging procedures had developed during the week.

"I learned quite a bit. Not just academically, but on a human level." SR116

This was encouraging and illustrated that the simulation week had led student participants to meaningful reflections and evaluations.[52] Patient-centred care is now reported on as a theme of its own.

Patient-centred care

An objective of introducing the simulation-based education package was to increase student's levels of awareness of patient-centred care. Diagnostic radiography as a profession has previously been characterised as task focused, with a tendency to reduce patients to their presenting condition or by their examination referral.[53,54] Research carried out by Hyde and Hardy has defined informed measures of patient-centred care in diagnostic radiography, and elements of their research findings were incorporated into the simulation scenarios.[54–57] It was hoped that by increasing student's clinical and technical skills via the simulation package, they would have more capacity to focus on providing patient-centred care when on placements.[11,22] Additionally providing students the opportunity to gain the patients' perspective through role play would improve empathy for the patient. Comments from student participants indicated that the simulation package did achieve this objective, and there were several insightful comments about how the week had helped them to develop their patient care skills.

"I feel much more confident in getting diagnostic images whilst maintain[ing] patient focused care" SR108

"It has also shown me that a simple task of putting a patient's bed back together after their x-ray, cleaning a patient's glasses or giving them a blanket can make a big difference to them providing quality patient care" SR125

It is hoped that as students continue to progress through the programme, they can continue to apply this knowledge to their clinical practice and provide truly patient-centred care.

Simulation to replace clinical placement hours

The results indicate the simulation-based education package was a successful replacement for one week of clinical placement time. The number and range of activities within the week appeared to be appropriate and engaging. Student participants reflected on the level of experience they had in clinical placement and applied this to their learning during the simulation. The focus of this differed slightly dependent on the timing of the simulation week within the placement block. Student participants engaging with the simulation with no prior clinical placement experience found this prepared them more fully for what to expect. Those that had the simulation week in the middle of their placement block were able to discuss similar cases and bring personal experiences to the discussion. Those that had the simulation towards the end of their placement block found the simulations offered an opportunity to resolve unanswered questions and fill gaps in their experience. However, some student participants did raise a wish to have had this simulation package ahead of their clinical placement block, this is linked to pre-placement anxiety as discussed previously.

Hedges, Ingleby and Cosson[47] propose that simulation designed into the curriculum should align the different domains of learning; with students seeing value in the simulation exercises. As student clinical placement hours were assigned to the simulation-based education package, this permitted students to see the importance of the activities improving engagement and the resultant positive outcomes.

The simulation-based education package added a richer experience due to the mix of students from different clinical placement sites, which was intentional to increase capacity on all placement rotations and to enable sharing of practice. This enhanced knowledge transfer, particularly with respect to varying clinical protocols, policies, and radiographic technique. The simulation-based education package also provided an opportunity for transformative learning, sharing experience through 'story telling' and using 'props' to enhance the authenticity of the situation.[58] Furthermore, the inexperience of some students in clinical areas could be offset by the experience of others.

Shiner and Pantic[59] identified there can be distinct differences in available resources at HEIs to develop various simulated activity. However, simulation provides an opportunity to become inventive with resources. Shiner[22] identified various simulations that all reported positive outcomes. A perceived lack of resource should not discourage HEIs from developing a simulation package to support student learning or replace some clinical hours, so long as the principles of good, simulated planning and delivery are followed.[34]

Limitations

It is clear from the reflective blogs that the student participants learnt a lot during the simulation-based education package. Student participants were aware their blogs would be analysed if they consented to participate in the evaluation, and it is acknowledged that this may have introduced social desirability bias.

The research was undertaken at one UK HEI. Simulation resources currently differ significantly between education providers, so replication of the simulation-based education package may be challenging for institutions, with less simulation equipment. This makes it difficult to consider the generalisability of the evaluation.

Conclusion

Increasing student numbers in radiography education is often limited by the availability of suitable clinical placements. SBE has become an established pedagogical approach within diagnostic radiography, as an alternative to clinical placement, that provides practical experience in a safe environment, and supports students through all the domains of learning.

The introduction of a one-week simulation-based education package (equating to replacement of 30 clinical placement hours) at one UK HEI has been perceived as valuable by student participants. Student participants described being able to move from feeling anxious to becoming more confident, with a greater awareness of patient-centred care. The use of scenarios, high fidelity environments, across a range of modalities meant students developed their understanding and applied a higher level of skill by the end of the experience.

The use of the simulation-based education package is a suitable replacement for one week of clinical placement for first year student radiographers. Further research will be undertaken to ascertain the views of the clinical partners on this pedagogic approach, with a view to introducing further simulation-based education packages for year 2 and 3 student radiographers.

Conflict of interest statement

None.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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