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The effect of different patient-based learning models on student perceptions of empathy, engagement, knowledge, and learning experience

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ABSTRACT

Background: Problem-based learning is used widely in pharmacy and medical programmes, incorporating realistic patient scenarios into regular teaching as a way of linking theory to practice. Routine case-based learning lessons ranges from real patient involvement, scripted patient scenarios, digital simulations (avatars) as well as through media such as Zoom. The existing literature has explored the extensive benefits of using patients in clinical education, but fewer studies have directly compared the efficacy of each model as learning tools.

Aim: To compare student perceptions of patient-based learning models to elicit student empathy, increase engagement, improve knowledge, and enrich learning experience.

Methods: A questionnaire was distributed to second-year pharmacy students in Swansea University to gather their perceptions on the nine different patient-based learning models in their routine teaching (SUMS RESC 2023-0011). Students were asked to rank their experience of the models explicitly against each other, based on the four pillars of (1) eliciting student empathy, (2) increasing engagement, (3) improving knowledge and (4) enriching the learning experience. Students were also asked to rate the significance of realism (i.e. knowing the patient demographics/having a visual representation of the patient) to their experience.

Results: Altogether, 31 student rankings of the nine learning models were weighted (9 = highest rank; 1 = lowest ranked). The data showed clear preferences for real-patient involvement over fictional cases, especially for eliciting empathy. Interestingly, scripted scenarios were rated highly for both engagement and learning experience only when avatars were involved, which suggests a role of animated visual representation of the patient in facilitating these outcomes.

Conclusion: Whilst it is useful to have multiple patient-based learning models, this study serves as a guide for educators in preparing case-based learning sessions for achieving the desired outcomes of any of the four pillars above.

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Problem-based learning; case-based learning; simulation-based learning; patient-based learning models; avatars; realism; empathy

1. Introduction

1.1. Problem-based learning

Problem-based learning (PBL) is a teaching method whereby students working in groups are tasked with collaborating, discussing, and eventually solving a problem posed to them by their teacher (Allen et al. 2011). Since its development in the 1960s (Barrows 1996), PBL has been incorporated extensively into undergraduate medical programmes across the United Kingdom and around the world (Wood 2003). These PBL sessions typically involve students being given a 'trigger' stimulus as a foundation for their own self-directed research, after which they would discuss their findings with their group members (Wood 2003).

According to Trullàs et al. (2022), PBL has the potential to improve future doctors' skills in communication, problem-solving and self-directed learning. With such promising results, it has become important to attain a comprehensive understanding of what exactly makes these sessions beneficial to students and why.

Practice points

- Student empathy for patients is always most elicited with real patient involvement.
- Real patient involvement does not always translate to a better overall learning experience and gaining of knowledge, compared with virtual or simulated patients.
- Having visual representation of the patients and understanding the demographics of the patients help in eliciting student empathy, increasing engagement, constructing knowledge, and enriching learning experience.

1.2. Case-based and simulation-based learning

Case-based learning (CBL) and simulation-based learning (SBL) overlap with PBL. Although there isn't a strict definition of CBL, it aims to connect theory to practice by giving students authentic patient cases to solve and ameliorate (Thistlethwaite et al. 2012). CBL is advantageous in that it is able to help students in their clinical reasoning and problem solving (McLean 2016).

On the other hand, SBL relies more on its immersive aspect to provide students with a realistic experience of

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patient interaction. For example, the use of simulated patients in student learning would fall under this category. SBL is similar to CBL as it involves integrating theoretical knowledge with practice (Wu et al. 2022). Simulated patients are used often in undergraduate medical programmes and increasingly in pharmacy and nursing courses (Nestel et al. 2011). As of now, SBL is also a constituent in routine nursing education courses (Lee et al. 2019).

However, it is important to also delineate the differing theoretical considerations between CBL and PBL. Unlike PBL, CBL focuses primarily on real-world cases (McLean 2016) with appropriate actions to solve a problem, while PBL's strict definitions of its features has been considered uncertain by some in the past (Newman 2005). In modern literature PBL is considered more complex and exacting than CBL (Pinto 2022), which requires an explanation of the phenomena. Pinto (2022) also highlighted two other key points, namely that CBL may facilitate the incorporation of PBL into teaching, but also that attention needs to be made when deciding the best format in which these didactic modalities are implemented.

There are different ways in which CBL or SBL can be carried out, either as a single patient case which follows the progression of a disease or disorder, or multiple patient cases which depicts different pathologies. They can be purely clinical (presented as simulated patient experience in this study), or a combination of science and clinical knowledge (presented as integrated case studies in this study).

1.3. The impact of COVID-19 on problem-based learning and the advent of digital methods

Previous studies have covered the benefits of digital PBL methods, including its efficiency and efficacy in teaching (Mistry et al. 2019). Unlike traditional PBL, digital PBL takes its pedagogical approach from connectivism (Delungahawatta et al. 2022) rather than constructivism. Tudor Car et al. (2019) has shown that digital PBL methods are as effective as traditional PBL methods in improving knowledge and may be more effective than traditional PBL in improving skills. Furthermore, Chao et al. (2021) has highlighted that in a post-COVID-19 world, the arrival of digital PBL media is especially important following the subsequent acceleration of medical education and changes in the way people interact. Zoom has served as a successful teaching medium for facilitating communication in Higher Education (Krome 2021), making it an applicable virtual platform for PBL and SBL (Ohnigian et al. 2021). Furthermore, in recent years online toolkits such as Xerte have been incorporated into teaching due to their applicability as an e-learning tool as well as high interactivity (Salmon et al. 2019). The ubiquity of these platforms post-COVID-19 as well as their extensive benefits and relevance highlights the need to improve understanding of how these virtual methods work compare to other learning models.

1.4. Patient-based learning models

Patient-based learning models (PBLMs) describe the inclusion of real, virtual, or fictional patients as a tool in CBL, SBL or PBL. These models can vary dramatically, including patient portrayal in various media accommodating a multitude of pathologies. These models are therefore very flexible, which is likely why they are used so extensively in education. Ge et al. (2022) found that the inclusion of PBLMs in learning programmes was successful in optimising clinical education of students and improving their communication skills.

The advent of digital and virtual methods in education has also transformed the uses of PBLMs. Patients are now able to be simulated digitally, providing educators with the tools to create enriched learning scenarios for students. This is depicted by the use of artificial intelligence (AI) and avatars (such as synthesia.io) in teaching, but also through media such as Zoom. These technologies are improving the ability of students to collaborate, as well as their engagement with the knowledge gained from their courses. Wood (2008) states that by presenting knowledge in a situation where it is relevant (like in a PBLM), it helps learners to engage with the information and retain it better.

There are several PBLMs that can be applied to routine teaching. However, the literature details that clinical placements remain the 'gold-standard' for clinical education and experience (Partner et al. 2022). These placements also provide students with experiences of patient interaction in authentic clinical settings (Nyoni et al. 2021). Other PBLMs, such as recorded videos of real patients, are not as well documented in the literature. Alongside placements, there are models featuring patients in fictional or simulated settings, such as simulated patient images/videos in scripted scenario sessions. Meanwhile, Xerte as previously described, allow students to access a clinical problem with simulated patients and work through the scenario for self-directed learning.

Incorporating the use of PBLMs in PBL sessions means that these models and their use must also be optimised. The basis of a successful PBLM could be in part its ability to develop qualities in students throughout their course to aid them in becoming effective clinicians, and for meeting the learning outcomes of healthcare education. These qualities, outlined in Figure 1, are empathy, engagement, knowledge, and learning experience. These qualities are keywords found in the requirements for organisations providing initial education and training for pharmacists. Empathy to the patient condition, are of vital importance in providing patient-centred care (Greiner and Knebel

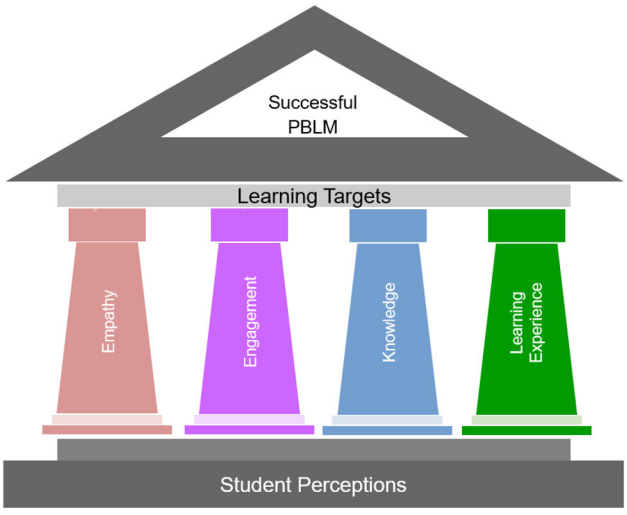

Figure 1. Pillar diagram highlighting the role of the four learning targets in contributing to a successful patient-based learning model.

2020). Coates (2005) outlines how student engagement is necessary in the quality assurance of Higher Education. Meanwhile, providing valuable knowledge to students is a goal of teaching. The quality of these factors also affects the overall quality of students' learning experience.

These values were selected for investigation due to their role in extant learning theoretical frameworks. The foundation of PBL is in constructivism (Hmelo-Silver and Eberbach 2011), a learning theory that posits that learning and knowledge is an active process facilitated by real-world individual and social experience (Narayan et al. 2013). Hence, student perceptions of knowledge and learning experience were gathered. Furthermore, the role of student engagement has been highlighted in the literature for this framework (Zajda 2021), due to the active nature that this learning type offers PBL as well as the role of social constructivism. And so, student perceptions of their engagement were gathered.

Despite the importance of PBLMs, the literature seldom makes direct comparisons between these models. A study from 2012 found that real-patient cases are the most effective at improving academic scores in students of PBL compared to routine lectures and paper cases (Li et al. 2013). However, this study focused primarily on academic scores, and doesn't take into account other targets of education, such as how engaging the models were or whether students were able to empathise with the patient. In fact, there is a lack of reported studies comparing the ability of each PBLM at developing the core values needed in healthcare professionals. Moreover, studies that have made comparisons often include too few of these models for many model-specific conclusions to be gathered (e.g. Li et al. 2013 only included three models: real, digital, and paper cases). In addition, the few studies that existed were randomised in nature. The researchers had the student participants allocated to cohorts that would each experience a different PBLM format. This separation made it impossible for participants to state their preferences of certain models as each student would experience only one PBLM environment. The constructivist pedagogical foundation of PBL is also such that PBL education should be student-focused (O'Connor 2020), thus the focus of this study is based on student perceptions on the different PBLMs involved.

1.5. Aim and objectives

The present study aims to broaden the knowledge of PBLM efficacy in educational environments. This study collects comparative data from students that explicitly ranks the different PBLMs against each other – this will be based upon the PBLM ability to elicit students' empathy, increase engagement, develop valuable knowledge, and enrich their learning experience. This study also explores the relevance of realism (i.e. knowing the patient demographics/having a visual representation of the patient) in an effective PBLM and PBL environment.

1.6. Methods

A class of second-year pharmacy students from Swansea University had nine different PBLMs incorporated into their routine teaching. This was done to ensure that students had the opportunity to experience all the learning models prior to the survey. The PBLMs include:

a. Interacting with real patients on placement
b. Interacting with real patients in lecture theatre
c. Interacting with real patients on Zoom
d. Watching pre-recorded videos of real patients
e. Going through PowerPoint/workbook with scripted scenarios and simulated patient videos/Avatars (integrated case study)
f. Going through PowerPoint/workbook with scripted scenarios and simulated patient images (integrated case study)
g. Going through PowerPoint/workbook with only scripted scenarios (integrated case study)
h. Going through PowerPoint/workbook with only scripted scenarios (simulated patient experience)
i. Going through Xerte/workbook (integrated case study)

With 9 = highest rank and 1 = lowest ranked according to students' perception, students surveyed were asked to rank their experience of the models explicitly against each other, based on the four pillars of (1) eliciting student empathy, (2) improving knowledge, (3) increasing engagement and (4) enriching the learning experience.

Based on a scale of 1–5, students surveyed were also asked to rate the significance of realism (i.e. knowing the patient demographics/having a visual representation of the patient) to their experience in accomplishing each outcome of the pillars above (see supplementary information).

Ethical approval (SUMS RESC 2023-0011) was obtained from Medical School Research Sub-Committee. The anonymised questionnaire was created using Microsoft Forms and the data stored there. This software was used due to its certified encryption of data. All participants have given informed consent.

The questionnaire, sampling, and survey strategy were pilot tested for pharmacy academics to examine the validity of the questions. The Likert scale in the questionnaire has traditionally and commonly been used to measure perceptions. The sampling of the survey respondents was completely unbiased and subsequently the inclusion of the whole second-year pharmacy class was deliberate. This was so that the results from the survey would be an accurate reflection of all the students' perceptions of the PBLMs. Considering all students' perceptions of the class in its entirety was to respect the diversity of the students in the pharmacy class. Only the most matured cohort at this stage was incorporated into the study as students in this cohort had experienced all forms of PBLMs. Due to the number of students within the study cohort the responses were collected *via* the Microsoft Forms Program in electronic format.

2. Results

31 student responses, out of 48 students invited to participate, were collected.

2.1. Empathy

Figure 2 presents that according to the students' perception, empathy was elicited markedly higher in PBLMs that featured real-life patients, followed by having visual

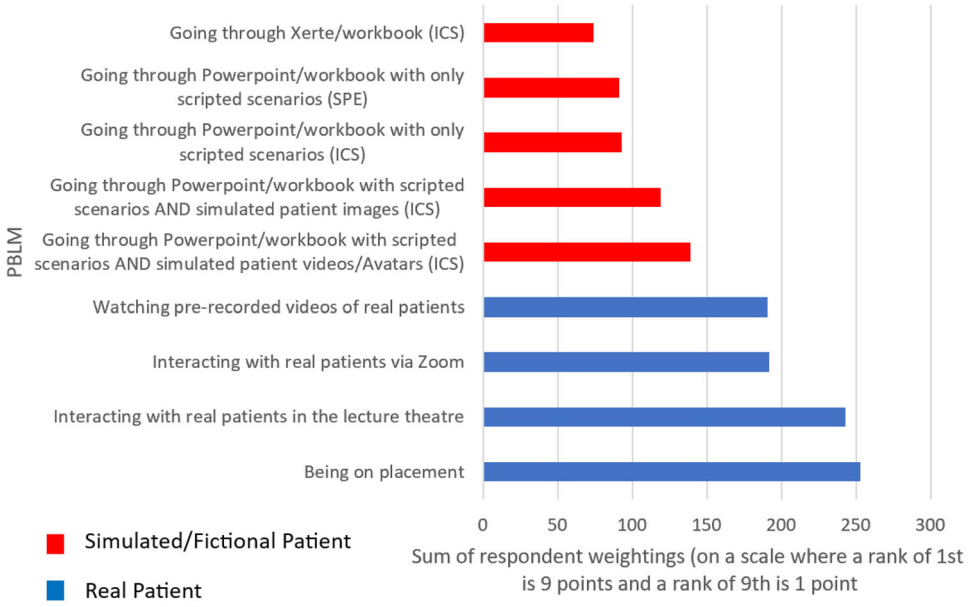

Figure 2. Bar chart representing the relative student preferences for each PBLM ranked by how well it elicited student empathy ($n = 31$).

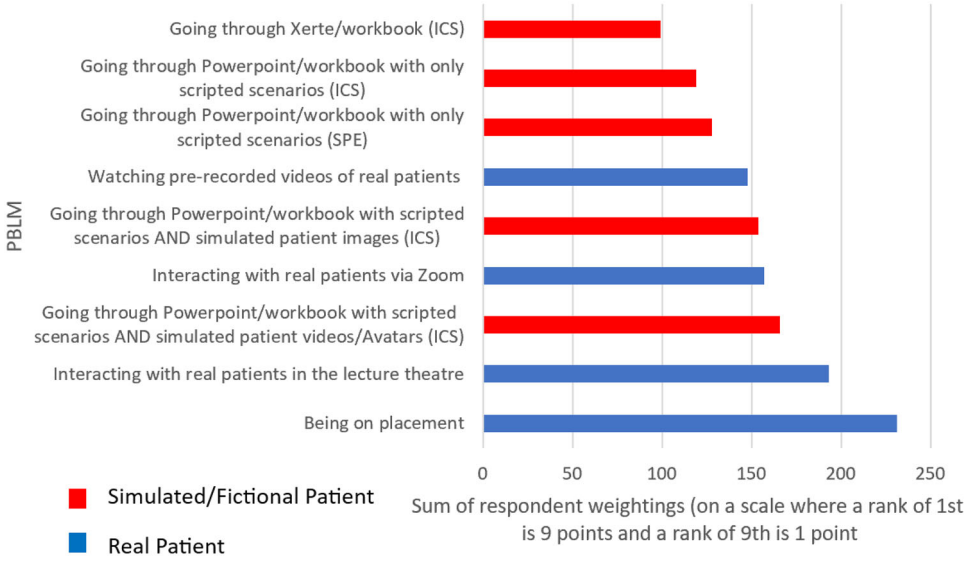

Figure 3. Bar chart representing the relative student preferences for each PBLM ranked by how well it engaged the students ($n = 31$).

representations of patients (video/Avatar > image), followed by fictional patients with only scripted scenarios, followed by Xerte. Placement performs the best for motivating empathy, whilst Xerte performs the worst, despite Xerte does portray a visual representation of the patient. It can be concluded that PBLMs featuring some sort of interaction (physical or verbal or sight) with the patient were more preferred than the scripted scenarios in this regard.

2.2. Engagement

Figure 3 shows that students found placements and in-person interaction with real patients to be most engaging than other PBLMs. Interestingly, simulated patient as an Avatar achieves the same level of engagement as interacting with real patients on Zoom and engages students better than watching pre-recorded videos of real patients. Simulated patient videos/Avatars are also more engaging for students than images. Xerte continues to be ranked as the least engaging, with only scripted scenarios performing not much better.

2.3. Knowledge

Figure 4 demonstrates that similar to engagement, placements and in-person patient interaction ranked the highest for developing knowledge amongst students. Integrated case study sessions with videos/Avatars and images perform better than sessions without visual representation of the patients. Watching real patients, whether live on Zoom or pre-recorded, performs equally as a knowledge resource, but not as good as simulated patients in integrated case study sessions with visual representations. Xerte again performs the poorest as a knowledge resource.

2.4. Learning experience

Figure 5 portrays that students' overall learning experience has identical trend as engagement. Simulated patient as an Avatar or with images, and watching real patients live or recorded on Zoom perform moderately the same for students' learning experience. As with all the other rankings, placements and in-person patient interaction ranked the highest.

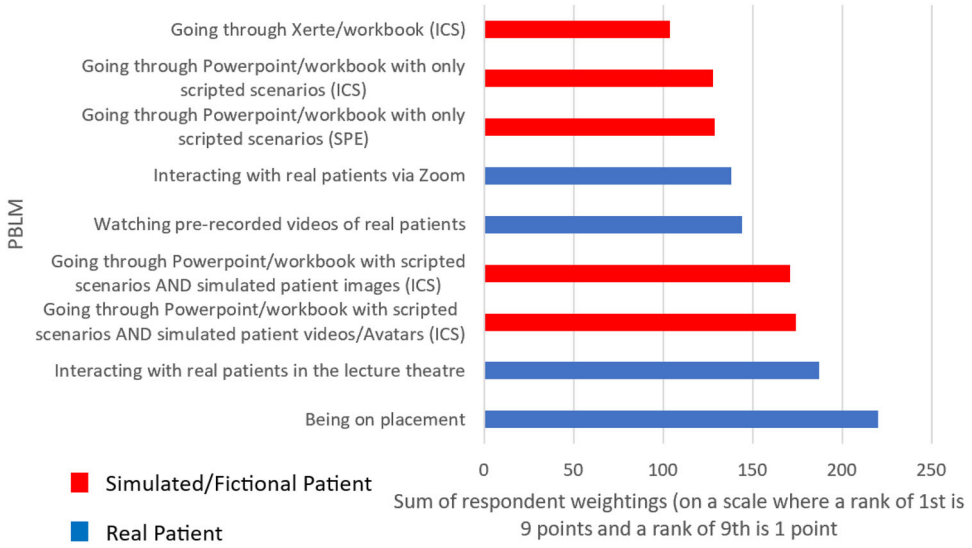

Figure 4. Bar chart representing the relative student preferences for each PBLM ranked by how well knowledge was developed in the students ($n = 31$).

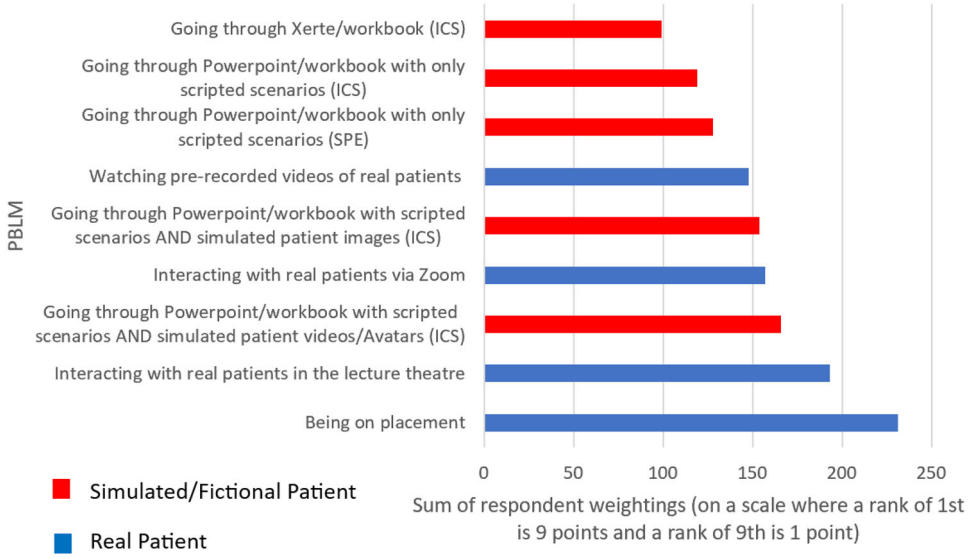

Figure 5. Bar chart representing the relative student preferences for each PBLM ranked by how well it enriched the student learning experience of the sessions ($n = 31$).

3. Discussion

3.1. Placements and in-person patient interactions

Student preferences for placement across all four pillars of learning targets highlight its importance in clinical education. For developing empathy, the highly ranked performance of placements aligns with previous literature stating that empathy is not developed with simulated or virtual patients (Quail et al. 2016). Quail et al. (2016) also elaborated that patient 'rapport-building' is vital to developing empathy, which further highlights the importance of interactivity with real patients. For encouraging engagement, students get to engage with real patients by asking them about their health and situation, using the WWHAM questions and related questions, whether they are on placements or with patients invited to the lecture theatre.

Although placements succeeded as the 'gold-standard' model in this study, attention still needs to be made to improve these activities. A few students in the cohort did not rank placement highly, likely due to several factors. The literature describes that clinical supervision is vital in clinical education, and inconsistent quality of this supervision can result in students feeling unsupported (Donough and der Heever 2018). Secondly, pharmacy students spend less time doing placement than other healthcare professions such as nursing and medicine. This results in these students having less time with the patients to engage with the clinical condition. Alongside this, perceived stress in pharmacy students during placement is considerable (Foster et al. 2018), and this needs to be considered given the stressful environment that placement in a hospital setting presents. Similarly, Koshy et al. (2017) highlights the significance of reflective practice to healthcare education and student learning experience. Less time with the patient as well as the rapid-paced nature of placement means a limited ability to reflect on the clinical experience.

3.2. Interactivity between real and virtual/simulated patients

This study shows that real patient involvement is superior to virtual or fictional patient models for developing empathy. This is in line with Li et al. (2013) which

described that real patient cases were superior to digital and paper cases in CBL. However, previous literature on this topic has mixed findings. Some studies show that real patients are preferred as a learning tool while some showing that virtual patients are preferred (Deladisma et al. 2007; Kleinsmith et al. 2015; Olsen and Oertel 2020).

For the other learning targets, the distinction between real and simulated patients is not as straightforward. The scripted scenarios featuring simulated patient videos/avatars outperformed watching recorded videos of real patients, as well as interacting with real patients through Zoom. This was the case in all categories except for empathy. These results support that in certain cases real patient involvement does not necessarily equate to a better learning experience, engagement and obtaining knowledge than with simulated patients. It is also important to note that there are problems within virtual patient implementation that need to be addressed to fairly represent virtual patients against the other PBLMs. Urresti-Gundlach et al. (2017) showed how virtual patients in Germany are not considered a realistic representation of real patients. This was hypothesised to be due to a lack of demographical information (such as unemployment and disability status) included in the backgrounds of virtual patients (Urresti-Gundlach et al. 2017). The demographics of the patient have been accounted for in this study, as they are perceived by students to be an important factor for achieving the learning targets (see supplementary information).

The students found demographic knowledge to be most beneficial in improving engagement and developing knowledge. Knowledge of patient information such as age, sex, gender, ethnicity etc., add authenticity to virtual patients. This did not align with previous literature that described high-fidelity SBL sessions to be similar in performance to low-fidelity sessions (Carnell et al. 2022). Carnell et al. (2022) detailed that the surprisingly lower performance of high-fidelity simulations is likely due to high cognitive load (i.e. the limited ability of a person to commit information to long-term memory at a given time). If cognitive load is excessive, this can inhibit the efficacy of high-fidelity simulations (Carnell et al. 2022).

The success of simulated patient videos over text-only fictional scenarios is consistent with previous comparisons of these models (De Leng et al. 2007; Nayak et al. 2023). On the other hand, there were very few studies in the literature to support why simulated patient videos are more preferred than simulated patient images. In support of images, Norris (2012) stated that they are considered an underrated tool in teaching, and that they can be useful in encouraging student learning reflection. It is possible that the simulated patient videos are seen as dynamic than simple images. For example, Chan et al. (2021) found that 360° videos may increase engagement over 2D short videos in medical education. Simulated patient videos, especially in an interactive format, may serve as an efficient tool to determine pharmacy student clinical reasoning skills (Cornelison et al. 2022; Plackett et al. 2022).

3.3. Xerte software

Xerte software performed the poorest out of all the PBLMs in each learning target. The literature contains very little information regarding healthcare students' perceptions of this software. However, it is important to note that Xerte may still be useful as a tool for clinical education for self-directed learning due to its ease of use.

3.4. Integrated case study vs simulated patient experience

The ICS sessions performed better than SPE sessions when ICS featured patient images/videos and SPE did not. It is likely that patient appearances as an image/video are what made ICS sessions perform better in all learning targets in the eyes of the students (see supplementary information).

Of the four learning targets, learning experience was the most enhanced by patient visual representation. However, the utility of patient visual representation to developing student empathy had the largest share of '5' ratings – meaning 'most useful at developing empathy' (see supplementary information). Empathy is a vital core quality of pharmacists that can be developed in lessons (Tamayo et al. 2016); therefore, it is crucial that educators ensure that patients are portrayed visually to help elicit these empathetic responses from their students and to build rapport.

The standard ICS scripted scenario sessions were not different to the scripted SPE sessions. During the SPE sessions students were given multiple case studies and the sessions were purely clinical. Meanwhile, the ICS sessions involve one patient case following the progression of the patient's condition (e.g. hypertension developing to heart attack; irritable bowel symptoms developing to inflammatory bowel diseases) and has a combination of scientific and clinical elements. As these sessions performed similarly well for achieving different learning outcomes, it would be beneficial for educators to incorporate both in their teaching.

3.5. Limitations of PBLMs

Although this study sought to measure the perceptions of the students fairly and efficiently in their routine teaching, there are several limitations to the study that future researchers should consider.

Firstly, the present study relied heavily on quantitative data to form its conclusions. Qualitative data would have provided the study with more rounded insights into student perceptions. This is a method that featured quite extensively in the literature, such as in the study of Li et al. (2013). Focus group is an example that students' perceptions can be recorded in detail. In retrospect, it would be useful if the study had detailed empathy information from the students using the Jefferson scale of empathy (JSE). The JSE is a credible test of empathy in health professionals' education and patient care (Hojat et al. 2018). Similarly, academic scores, on top of students' perception, could have been collected as an objective measure of PBLM efficacy in the academic context, which was displayed in Li et al. (2013).

Another factor that needs to be addressed is that only one cohort was used in this study. By using just one cohort the potential for bias may have been introduced. However, this was a necessary condition for students to be able to

experience all the PBLMs so that preferences could be gathered from each student. It is also important to note that the students' opinions on different lecturers' teaching styles will likely have altered the results. Similarly, whether the real patients involved in the teaching were lively or passive will directly affect student opinion on these sessions. Finally, out of a cohort of 48 students, 31 (65%) responded to the survey. The remaining 35% could potentially alter the findings from this study.

4. Conclusion

This study can be used as a reference for educators in choosing which PBLMs for optimising their PBL, CBL and SBL sessions, for achieving the different learning targets. Placements is the 'gold-standard' model out of the PBLMs featured in this study, but it is not necessarily most preferred by all students. Student empathy for patients is always most elicited with real patient involvement. However, real patient involvement does not always translate to a better overall learning experience and gaining of knowledge, compared with virtual or simulated patients. Having visual representation of the patients and understanding the demographics of the patients also help in eliciting student empathy, increasing engagement, constructing knowledge, and enriching learning experience. As this study focuses on students' perception, educators shall be able to see from the viewpoint of students what their preferences are, to ensure that students are receiving the PBLMs that suit their learning needs.

Disclosure statement

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