

Need assessment for history-taking instruction program using chatbot for nursing students: A qualitative study using focus group interviews

DIGITAL HEALTH
Volume 9: 1–8
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/20552076231185435
journals.sagepub.com/home/dhj



Yanya Chen^{1,2}, Qingran Lin^{1,3}, Xiaohan Chen² , Taoran Liu², Qiqi Ke¹,
Qiaohong Yang¹, Bingsheng Guan³  and Wai-kit Ming^{2,4} 

Abstract

Purpose: A comprehensive health history contributes to identifying the most appropriate interventions and care priorities. However, history-taking is challenging to learn and develop for most nursing students. Chatbot was suggested by students to be used in history-taking training. Still, there is a lack of clarity regarding the needs of nursing students in these programs. This study aimed to explore nursing students' needs and essential components of chatbot-based history-taking instruction program.

Methods: This was a qualitative study. Four focus groups, with a total of 22 nursing students, were recruited. Colaizzi's phenomenological methodology was used to analyze the qualitative data generated from the focus group discussions.

Results: Three main themes and 12 subthemes emerged. The main themes included limitations of clinical practice for history-taking, perceptions of chatbot used in history-taking instruction programs, and the need for history-taking instruction programs using chatbot. Students had limitations in clinical practice for history-taking. When developing chatbot-based history-taking instruction programs, the development should reflect students' needs, including feedback from the chatbot system, diverse clinical situations, chances to practice nontechnical skills, a form of chatbot (i.e., humanoid robots or cyborgs), the role of teachers (i.e., sharing experience and providing advice) and training before the clinical practice.

Conclusion: Nursing students had limitations in clinical practice for history-taking and high expectations for chatbot-based history-taking instruction programs.

Keywords

Artificial intelligence, history-taking, education, chatbot, digital health

Submission date: 12 November 2022; Acceptance date: 14 June 2023

¹School of Nursing, Jinan University, Guangzhou, China

²Department of Infectious Diseases and Public Health, Jockey Club College of Veterinary Medicine and Life Sciences, City University of Hong Kong, Hong Kong

³The First Affiliated Hospital of Jinan University, Guangzhou, China

⁴School of Public Policy and Management, Tsinghua University, China

Wai-kit Ming, Bingsheng Guan and Qiaohong Yang made equal contributions to this manuscript.

Corresponding authors:

Wai-kit Ming, Department of Infectious Diseases and Public Health, Jockey Club College of Veterinary Medicine and Life Sciences, City University of Hong Kong, To Yuen Building, 31 To Yuen Street, Hong Kong, China; School of Public Policy and Management, Tsinghua University, China.
Email: wkming2@cityu.edu.hk

Bingsheng Guan, The First Affiliated Hospital of Jinan University, 613 Huangpu Avenue West, Tianhe District, Guangzhou 510630, China.
Email: guanbingshengxy@163.com

Qiaohong Yang, School of Nursing, Jinan University, Guangzhou, China. 601 Huangpu Avenue West, Tianhe District, Guangzhou 510632, China.
Email: yqiaohong@163.com



Introduction

History-taking is one of the essential nursing skills that nurses use to source important and intimate health-related information, help nurses to make preliminary clinical judgments, and facilitate the establishment of a therapeutic relationship between the nurse and patient.^{1,2} Mastering history-taking is a fundamental requirement for nurses as a comprehensive health history is helpful for identifying care priorities and the most appropriate interventions that can optimize patient outcomes.³ Nevertheless, most nursing students and novice nurses find history-taking difficult to learn and develop, and their overall level is not satisfactory.⁴ Important influencing factors of effective history-taking included communication ability, theoretical knowledge, clinical thinking, and experience.^{2,5} Among the existing teaching methods, including peer role-playing, using standard patients, bedside demonstration, and clinical practice, clinical practice, which can provide real experience, is the best option for history-taking training.⁶ But with limited clinical experience, nursing students are challenged by interviewing patients while their psychological stress is prominent in a real clinical environment.⁷ Hence, systematic learning and continuous training are necessary for history-taking training before they enter a real clinical environment. It was indicated that the integration of artificial intelligence (AI) in undergraduate nursing education will benefit practice as it has the potential to prepare nursing students to practice repeatedly, safely, and efficiently.^{8,9}

Artificial intelligence is a new buzzword in healthcare and higher education, hailed as a strategy to solve problems affecting students, educators, health professionals, and patients.¹⁰ Although it is easy to identify the recent popularity of introducing AI in the nursing field, most current research focused on nursing practice clinical settings rather than nursing education.¹⁰ As an application of the AI field, chatbots are natural language processing systems performing as virtual conversational agents and have the potential to perform complex tasks by interacting with human users.¹¹ A study using a virtual chatbot in nursing education confirmed the potential effectiveness of chatbots in teaching effective nursing communication skills.¹² With regard to history-taking skills, chatbots were suggested by students to be used in the area where they have to practice history-taking.¹³ Still, there has been a lack of content and programs for history-taking instruction using chatbots. The development of such programs requires an assessment of problems in clinical practice for history-taking and identifying nursing students' needs. Accordingly, this study aimed to explore the vital components of chatbot-based history-taking instruction programs for nursing students through focus group interviews.

Methods

Design

Focus groups were designed to explore the participants' perceptions in a specific topic within a permissive and non-threatening environment. It relies on the assumption that group interactions can help participants express and clarify their views in ways less likely to occur in a one-on-one interview. Participants who share specific characteristics in a focus group setting may feel safer or less anxious when talking about difficult experiences.¹⁴ Focus group interviews were adopted as the data collection method in this qualitative investigation since it could gain a deeper understanding of participants' perspectives or feelings regarding a specific topic. The size of focus group interviews groups ranged from 5 to 6 students, following previous literature.¹⁵

Participants

The inclusion criteria were 3-year undergraduate nursing students from a full-time 4-year college; learned the history-taking knowledge as part of the Health Assessment Curriculum; have finished the clinical practice of the Health Assessment Curriculum; and voluntary participation. We advertised the study through 5 min PowerPoint presentation at the beginning of a nursing course at a Chinese university. Invitation letters with the principal investigator's contact information were handed out to the students on the day. In total, 22 students consented to participate in this study.

Data collection

Data were collected in April and May 2022. Students interested in participating contacted the principal investigator to arrange for data collection in a quiet and isolated meeting room on the campus. They signed a declaration of consent. Each participant was informed that they could quit anytime and that the study was not a formal component of their education program. The focus group interviews were conducted in Mandarin and audio recorded using a semi-structured interview (The guiding questions are listed in Table 1).

The interview consisted of two sections. In the first part, participants explained how they perceived history-taking training in clinical practice. In the second, main part, the researcher provided a brief overview regarding the current state of artificial intelligence (including chatbot) in the field of nursing,^{16,17} to ensure that all participants had the same basic understanding. Then, interviewees could express their needs, expectations, and thoughts in a dialogue fashion about chatbot applications in history-taking instruction programs.

Table 1. Focus group questions.

Categories	Questions
First part	1. Have you undergone clinical practice for history-taking?
	2. Please share your feelings about history-taking training in clinical practice.
Second part (main part)	1. Please describe what you feel about chatbot using in history-taking instruction program.
	2. If chatbot was used in nursing education, how would it assist your improvement of history-taking skills?
	3. If a chatbot-based instruction program was to be developed for history-taking, what would you like to have experienced?
	4. If a chatbot-based instruction program was to be developed for history-taking, what situations or form would you deem as appropriate?
	5. Do you have any suggestions when chatbot-based instruction program is to be developed?
	6. Is there anything else you want to add to the interview content?

The interview would be stopped when no new statements or contents emerged. Finally, the focus group interviews lasted between 43 and 50 min with an average of 47 min.

Data analysis

Colaizzi's phenomenological methodology was used to analyze the qualitative data generated from the focus group discussions.^{18,19} Colaizzi's seven-step approach for data analysis included (a) step 1, gaining an understanding of the content and meaning of each transcript, (b) step 2, identifying key or noteworthy statements from the narrative, (c) step 3, deriving or constructing meanings from important statements, (d) step 4, categorizing formulated meanings into thematic clusters, (e) step 5, offering an exhaustive depiction of the phenomenon, (f) step 6, recognizing the underlying framework of the phenomenon, (g) step 7, providing exhaustive descriptions back to the participants. To ensure that our methods were transparent and replicable, the findings of the paper are presented to adhere to the Consolidated Criteria for Reporting Qualitative Research (COREQ).²⁰

Results

This study involved 22 students (i.e., five males and 17 females) aged 21–23 years. All students were divided into four groups for the focus group interviews. Three main themes were identified which were further categorized into 12 subthemes.

Limitation of clinical practice for history-taking

Limited chances. Given that the number of students' admission was increasing and the models of care were changing, nursing students possibly had limited opportunities to practice their skills and improve their ability to care for patients in clinical setting.²¹ When talking about clinical practice for history-taking, the majority of participants stated that the chances for each student were extremely limited. In this study, students discussed some reasons accounting for their limited opportunities. Firstly, when students took the history of the elderly who spoke Cantonese or other dialects, the language barrier became a significant obstacle and they had to give the chance to other students. Secondly, with the increasing number of students' admission and the need for clinical practice, teachers overcame this by dividing students into groups. Thus, often, all most students could do was to ask the real patients one or two supplementary questions after the delegates' practice in their groups, although fellowship was perceived as a good way to learn from and with each other by a few students.

"I never perform history-taking independently ... A lot of patients, especially the old people, mainly speak Cantonese (one kind of dialect in the southern part of China), it's hard for us to comprehend ... It's a pity, but I have to give the opportunities to others ... sometimes, my teammate would translate the contents to me" (Participant R)

Patients' unwillingness. Participants reported that taking a history of a real patient was very difficult and they usually faced situations in which patients were reluctant to be models for students to practice history-taking skills, presumably owing to privacy reasons or poor physical condition. Furthermore, after being taken history by different groups of students several times, some patients showed unwillingness and became impatient with them. A few students noted that some patients would refuse to tell the truth and even tell lies, although friendliness and smile were shown on their faces.

The patient gave me sweet smiles but told me the wrong information about his symptoms ... after consulting some documents, I found he lied to me (Participant E)

Could not practice effective communication skills. Effective communication skills were integral in the nursing profession as

appropriate communication skills helped to make the history-taking process harmonious and ensure the accuracy of medical history. Students stated the importance of communication skills and commented that they could not effectively practice their communication skills through clinical practice. While effective communication involved one's abilities to explain, listen and empathize, the instructors had already explained and asked the patients for consent about students' practice in advance so that the patients would not feel confounded to students' history-taking. Therefore, most students expressed that they did not have enough opportunities to explain, and they usually asked the patients some questions related to medical history straightly without any introductory questions or transition questions.

We lose chances to communicate with patients ... The clinical instructor helps us to explain the aims and process of our clinical practice for history-taking before ... we only need to ask some questions about patient's disease without others (Participant D)

Perceptions of chatbot use in history-taking instruction program

More opportunities to practice history-taking. Due to the increased rights of patients in the current healthcare environment, nursing students were allowed to deliver limited amounts of care and nursing practices in a clinical setting during clinical practice. Students stated that history-taking requires them to learn in a systematic way as well as practice continuously and repetitively. They commented that chatbot was a new way to develop their history-taking skills, except for some commonly used teaching methods including role-playing and clinical practice. It would mean that number of real patients available would not limit the opportunities history-taking as chatbots could serve many nursing students at one time. Additionally, by allowing repetitive practice, the chatbot could provide students with more opportunities to try and make errors. For students who were introverted and shy and who did not have reinforced theoretical knowledge, the use of chatbots would make them feel less stressed for trial and error.

This will be a new way for me to learn. If this kind of chatbot could be designed in the future, I would practice many times before meeting real patients (Participant E)

Become confident in history-taking. Interviewing patients was challenging since learning and developing history-taking skills was difficult, especially for nursing interns and nursing students with insufficient clinical experience. Increased anxiety and lack of confidence were prominent among students when they interacted with a real patient

in a clinical environment. The chatbot could provide students with the opportunities to practice history-taking repeatedly which could help them overcome the limitations of clinical practice. Many students stated that they would benefit from repetitive practice using a chatbot, which could help them learn what they need to focus on during clinical practice. These could help them build their confidence and make them feel more prepared and easier to take a history of a real patient, finally helping them make good use of real patients for history-taking training during clinical practice.

After numerous history-taking training through chatbot, maybe ... I will feel more prepared (Participant T)

Being curious. In spite of the increasing interest in emerging technology, medical education, and nursing education have not kept pace with the remarkable breakthroughs of artificial intelligence. As an emerging technological concept, knowledge of the current status of artificial intelligence or chatbot was modest among nursing instructors and students. Many participants described the use of chatbots as a "new concept" that was different from what traditional teaching methods (e.g., peer role-playing and clinical practice) were doing. They were curious about how the chatbot would react to their questions, which could incentivize them to try it out if it could be designed in the future. However, several of these students also expressed their fear when the chatbot looked extremely like a human and their worry about hindering their empathy if the design of the chatbot lost sight of compassionate care.

I just wonder what the chatbot will look like ... If I ask it some questions about medical history, will it answer me like a real man? ... If possible, I am willing to try it (Participant Q)

Need for history-taking instruction program using chatbot

Feedback. Many students valued the importance of feedback, which might help to promote their self-learning. They hoped that they could review or know the missing points and areas through the feedback. Interestingly, while a few students suggested the checklist function at the end of the chatbot-based history-taking instruction program, more students thought that it was useful to provide them interruptions and instant feedback during their training since they thought verbal history-taking training was something different from practical skills.

It is hard to remember what questions I had asked after training. Therefore, I would rather be interrupted by the program... then I know what I did wrong and what I missed through the feedback ... (Participant R)

Diverse clinical situations. According to participants' descriptions, when the chatbot was used as a patient simulator, they wanted to learn how to take the medical history of different patients in diverse clinical situations. Patients in different clinical situations meant different levels of difficulty for students' history-taking. Students expressed that situations, such as familiar wards or units, would be more suitable for their early training. However, after practice for several times, they also wanted to learn how to communicate with patients in clinical situations that they seldom experience. Some participants further elaborated that it would be fun if the chatbot-based instruction program could provide cases that were relatively rare.

I think it would be helpful for us to experience some emergency situations if we have already practiced ...For example, if the patient's state worsened suddenly, what should you focus on when you were taking his medical history? (Participant A)

Chances to practice nontechnical skills. While newly graduated nurses should be equipped with effective communication skills to ensure the optimal patient care experience, nursing students also need to be compassionate, empathetic and maintain a patient's dignity. The students reported that they tended to focus on history-taking skills in clinical practice, and often neglected the focus and importance of other specific and nontechnical skills, including communication skills and skills for providing empathy. They hoped that multiple tries provided by chatbots could help them to learn and remember some technical aspects of effective communication skills. Additionally, they hoped the chatbot could be designed as an emotionally responsive robot which could help to improve their ability to show empathy.

I think it would be better if the chatbot could provide us with some opportunities to improve other skills except history-taking, like using the correct words and phrases to comfort the patient (Participant F)

Form of chatbot. More than half of the participants showed a greater preference for practicing history-taking skills with humanoid robots or cyborgs. They thought that would make them feel they were interacting with a real patient whereas interacting with a screen lacked realism. Two participants further elaborated that the appearance of humanoid robots did not need to look extremely like a human, otherwise, they would be frightened. However, some of the remaining students reported that virtual chatbots were more acceptable, flexible, and reproducible, which could cater to multiple students simultaneously.

Virtual chatbot would make me feel I am not taking history of an actual human, but of a cartoon on the screen, and I would do it (perform history-taking) carelessly, either unknowingly or knowingly (Participant H)

Teachers' role in chatbot-based training. The incorporation of new technologies into nursing education could help to increase comfort and familiarity when nursing students entered the clinical setting. In higher education, artificial intelligence was emphasized as a new strategy to extend the capabilities of teaching staff and improve students' learning process instead of replacing educators. The majority of participants also emphasized the role of teachers in the scope of history-taking training, highlighting that teaching staff could not be replaced with chatbots completely since they could share their experiences with students. They hoped that nursing teachers could provide some useful advice according to their clinical experience after chatbot-based history-taking training.

If we performed the chatbot-based training, I don't think the teacher could be inexistent ... advice and tips from teacher after chatbot training will be more helpful to improve learning outcome (Participant D)

Chatbot-based training prior to the clinical practice. Regarding the timing of training, in the interviews, the participants highlighted the potential pragmatic value of the chatbot-based training and wanted to undergo chatbot-based training prior to the actual training in the clinical settings. With the application of the chatbot before entering the clinic, nursing students would not be encumbered by concerns about poor performance, psychological stress when interacting with a real patient, or criticism from teachers or classmates. However, some students stated that after entering clinical practice, they would not use it anymore as they thought successful history-taking was complicated while chatbots could not be able to comprehend the emotional aspect of real humans and thus would not provide an extremely realistic experience for history-taking.

I think it would be better if we perform chatbot-based training in advance and then enter the clinic to take a history of a real patient (Participant G)

Discussion

This phenomenological study assessed the need regarding chatbot-based history-taking instruction programs for nursing students. The included participants experienced a variety of limitations during their clinical practice for history-taking, including limited chances, patients' unwillingness, and

not having enough opportunities to practice effective communication skills. However, students had different expectations about the implementation of chatbot-based history-taking training, proposing ideas that these programs should be in the form of humanoid robots or cyborgs, and provide feedback, diverse clinical situations, and chances to practice non-technical skills. They also stated that the role of teachers could not be replaced with chatbots completely while they hoped to receive chatbot-based training before the clinical practice.

Nowadays, with increasing patient expectations, emerging health needs, and increasing patient rights, nursing students were only allowed to provide limited actual practices in the clinical setting, which would limit their clinical practice experiences.²² Furthermore, clinical practice experiences were often limited to the simple observation of nurses' or other students' activities because of the increasing number of students' admission and the language barrier.²² Unlike previous generations, young nursing students born after 1982, known as the "Net Generation," were highly digitally literate. To engage and retain the attention of these students, educators were advocated to adapt to the changing nature of students by using appropriate teaching strategies rather than insisting on only traditional teaching strategies.²³ Hence, efforts have been made to advance history-taking training by virtual patients. For example, a software program with virtual patients on the Wechat platform was developed for nursing history-taking self-practice. Nevertheless, the image of the virtual patients did not simulate active expressions or gestures and their responses did not match the students' queries well.²⁴ Another e-learning program, the vSIM program, also involved history-taking session.²⁵ However, it was under the control of the programmer, i.e., everything was preset from the correct answers.²⁶ By contrast, AI could "learn" and change in unpredictable ways which might be expected to offer learning sources to help or encourage learners to learn some components that were hard to understand.²⁶ Furthermore, emotionally responsive robots, such as Sophia, were designed to interact in ways that made them human and were even given citizenship in a country.¹⁷ These demonstrated the potential of AI which would not be limited to the simple cartoon image without gestures or facial expressions. It was revealed that nursing students' transition to practice might benefit from the application of AI to facilitate their learning in undergraduate nursing programs.²⁷ Therefore, in the age of AI, it was urgent and essential to reform the curriculum in academic institutions to enable nursing students to practice efficiently and safely.⁸

The nursing students in this study had high expectations for chatbot-based history-taking training, because, and even though, they had little or no prior knowledge of AI technology.²⁸ They hope to have more opportunities to practice and become confident after training using chatbots. Similarly, one article stated that AI technology had

potential to enhance nursing students' self-efficacy and confidence before their clinical practice in a real-life clinical environment.²⁹ Furthermore, nursing students wanted to experience diverse clinical situations and receive training through humanoid robots or cyborgs. It was predicted that the increasing presence of humanoid robots would complement the currently available high-fidelity simulator in clinical simulation labs, while the use of AI was expected to increase greatly in nursing education in academic institutions.³⁰ Chatbots could be created for a tutoring system and used to practice interviewing patients.⁹ A qualitative study conducted among medical students and academic medical staff reported that a chatbot could be used to practice history-taking by acting as a patient.¹³ Participants in this study want to be trained using chatbots prior to their clinical practice, in line with the previous study highlighting that chatbots for history-taking training would be most useful in the earlier period of medical learning rather than the later period.¹³ History-taking was challenging for nursing students, requiring systematic learning and continuous practice.²⁴ Through chatbots, fair practice opportunities could be provided for all students and the number of healthcare professionals and patients available would not limit the number of students being allowed to practice history-taking since chatbots could serve numerous nursing students simultaneously.^{12,13} These would make students in the earlier period of learning build their confidence before interviewing real patients.¹³

We deemed that the result of this qualitative study contributed to the future development of a chatbot-based history-taking instruction program by providing insights into the needs of nursing students who are the end-users. However, the development of the application of AI in the nursing education field remained in an inchoate status. While nursing students' needs to be reported in this study are specific, including experiencing diverse clinical situations, it requires the involvement of clinical specialists as they have the potential to provide expertise to devise different clinical situations when an effective chatbot-based history-taking instruction program is developed. In future studies, it is important to explore the opinions of clinical experts so that the program can meet both the users' needs and the institutions' educational goals. Furthermore, in this study, we found that when the chatbot was used as a patient simulator, students wanted to learn how to take the medical history of different patients in diverse clinical situations. Therefore, finding the patients' cases of the system and then collecting their medical history and other information is very important for developing the application of AI in nursing education. The existing ways to collect patients' information mainly included two types, i.e., questionnaire and digital tools. Each of them has advantages and disadvantages.³¹ Some questionnaires, which have already been used, can include their acute medical history, allergies, drug intolerances, and past treatments. Information can be collected

comprehensively and expeditiously, but transferring them into electronic medical records is tedious and time-consuming.³¹ The utilization of other digital tools specifically created for collecting medical history information could simplify and expedite this process, while most of them only focus on some specific patient populations, for example, cardiology and gastroenterology.^{32,33}

This study has several limitations. First, one limitation of focus group interviews is that certain participants may tend to provide more input or feedback on a specific question, while others may not contribute any comments or have a lower level of participation. These can lead to uneven contributions and biases in the data collected. Additionally, focus group interviews may not be representative of the broader population, as participants may not be a random sample and may not accurately reflect the diversity of the population being studied. Thirdly, since the progress of artificial intelligence has outpaced the development of medical education⁹ and the overview provided in this study regarding the current state of artificial intelligence and its use was brief, we thought it was still relatively difficult for nursing students to visualize possible uses for a chatbot. However, given that this study involved a detailed qualitative analysis, the small number of participants actually enabled a comprehensive evaluation of each participant's perspectives. The use of focus groups as a methodology also facilitated a direct interaction with the participants, allowing for posing key questions and gathering diverse opinions.

Conclusions

In conclusion, nursing students were confirmed to have limitations in clinical practice for history-taking including limited chances, patients' unwillingness to be models for students to practice history-taking skills and limited opportunities to practice effective communication skills. They also held high expectations for chatbot-based history-taking instruction program as they believed the program can provide more opportunities for history-taking training and help them become confident, while they were curious about chatbots. When developing the chatbot-based history-taking instruction program, their needs were large and specific, including feedback from the chatbot system, diverse clinical situations, chances to practice nontechnical skills, form of chatbot (i.e., humanoid robots or cyborgs), the role of teachers (i.e., sharing experience and providing advice) and training before the clinical practice. The results of this study could provide useful information for developing history-taking instruction programs using chatbots and might help to foster the development of the application of AI in the nursing education field.

Contributorship: Y.C. contributed to the conceptualization, data collection, data analysis, and writing of the original draft. Q.L. provided resources and critically revised the article. X.C.


contributed to the article revision. T.L. contributed to data collection and data curation. Q.K. contributed to data collection and data curation. Q.Y. contributed to the study design, funding acquisition, and critical revision of the article. B.G. and W.M. contributed to conceptualization, study design, data analysis, funding acquisition, and critically revised the article.


Declaration of conflicting interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval: Ethics approval was obtained from the Jinan University Institutional Review Board (Ref number: JNUKY-2022-034). Participation was strictly voluntary. All records and participant information were kept confidential.

Funding: The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was funded by The City University of Hong Kong New Research Initiatives/Infrastructure Support from Central [grant number 9610589]; The Fundamental Research Funds for the Central Universities [grant numbers 21622304]; the research project of teaching method reform of Jinan University, and SIRG - CityU Strategic Interdisciplinary Research Grant [grant numbers 7020093].

ORCID iDs: Bingsheng Guan  <https://orcid.org/0000-0001-8583-8045>

Wai-kit Ming  <https://orcid.org/0000-0001-7130-1300>

Xiaohan Chen  <https://orcid.org/0000-0001-5693-6439>

References

1. Ingram S. Taking a comprehensive health history: learning through practice and reflection. *Br J Nurs* 2017; 26: 1033–1037.
2. Lloyd H and Craig S. A guide to taking a patient's history. *Nurs Stand* 2007; 22: 42–48.
3. Fawcett T and Rhynas S. Taking a patient history: the role of the nurse. *Nurs Stand* 2012; 26: 41–46, 48.
4. Du J, Zhu X, Wang J, et al. History-taking level and its influencing factors among nursing undergraduates based on the virtual standardized patient testing results: cross sectional study. *Nurse Educ Today* 2022; 111: 105312.
5. McKenna L, Innes K, French J, et al. Is history taking a dying skill? An exploration using a simulated learning environment. *Nurse Educ Pract* 2011; 11: 234–238.
6. Zhao J, He H, Du J, et al. The effects of using virtual patients on the history-taking ability of nursing interns: a non-randomized controlled study. *Nurse Educ Pract* 2022; 59: 103289.
7. Isaza-Restrepo A, Gómez MT, Cifuentes G, et al. The virtual patient as a learning tool: A mixed quantitative-qualitative study. *Bmc Med Educ* 2018; 18: 297.
8. Buchanan C, Howitt ML, Wilson R, et al. Predicted influences of artificial intelligence on nursing education: Scoping review. *JMIR Nurs* 2021; 4: e23933.
9. Lee J, Wu AS, Li D, et al. Artificial intelligence in undergraduate medical education: a scoping review. *Acad Med* 2021; 96: S62–S70.

10. O'Connor S. Artificial intelligence and predictive analytics in nursing education. *Nurse Educ Pract* 2021; 56: 103224.
 11. Nadarzynski T, Miles O, Cowie A, et al. Acceptability of artificial intelligence (AI)-led chatbot services in healthcare: a mixed-methods study. *Digit Health* 2019; 5: 1344226368.
 12. Shorey S, Ang E, Ng ED, et al. Communication skills training using virtual reality: a descriptive qualitative study. *Nurs Educ Today* 2020; 94: 104592.
 13. Kaur A, Singh S, Chandan JS, et al. Qualitative exploration of digital chatbot use in medical education: a pilot study. *Digit Health* 2021; 7: 569681863.
 14. Grove SK, Burns N and Gray JR. *The practice of nursing research*. Netherlands: Elsevier, 2013.
 15. Dilorio C, Hockenberry-Eaton M, Maibach E, et al. Focus groups: an interview method for nursing research. *J Neurosci Nurs* 1994; 26: 175–180.
 16. von Gerich H, Moen H, Block LJ, et al. Artificial intelligence-based technologies in nursing: a scoping literature review of the evidence. *Int J Nurs Stud* 2022; 127: 104153.
 17. Robert N. How artificial intelligence is changing nursing. *Nurs Manage* 2019; 50: 30–39.
 18. Vignato J, Inman M, Patsais M, et al. Computer-Assisted qualitative data analysis software, phenomenology, and Colaizzi's method. *West J Nurs Res* 2022; 44: 1117–1123.
 19. Edward KL and Welch T. The extension of Colaizzi's method of phenomenological enquiry. *Contemp Nurse* 2011; 39: 163–171.
 20. Tong A, Sainsbury P and Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007; 19: 349–357.
 21. Cobbett S and Snelgrove-Clarke E. Virtual versus face-to-face clinical simulation in relation to student knowledge, anxiety, and self-confidence in maternal-newborn nursing: a randomized controlled trial. *Nurse Educ Today* 2016; 45: 179–184.
 22. Jeon J, Kim JH and Choi EH. Needs assessment for a VR-based adult nursing simulation training program for Korean nursing students: a qualitative study using focus group interviews. *Int J Env Res Pub He* 2020; 17: 8880.
 23. Han ER, Yeo S, Kim MJ, et al. Medical education trends for future physicians in the era of advanced technology and artificial intelligence: an integrative review. *Bmc Med Educ* 2019; 19: 460.
 24. Liu T, Luo J, He H, et al. History-taking instruction for baccalaureate nursing students by virtual patient training: a retrospective study. *Nurse Educ Today* 2018; 71: 97–104.
 25. Tjøflåt I, Brandeggen TK, Strandberg ES, et al. Norwegian Nursing students' evaluation of vSim® for nursing. *Adv Simul (Lond)* 2018; 3: 10.
 26. Walsh K. Artificial intelligence and healthcare professional education: superhuman resources for health? *Postgrad Med J* 2020; 96: 121–122.
 27. Sitterding MC, Raab DL, Saupe JL, et al. Using artificial intelligence and gaming to improve new nurse transition. *Nurse Lead* 2019; 17: 125–130.
 28. Swan BA. Assessing the knowledge and attitudes of registered nurses about artificial intelligence in nursing and health care. *Nurs Econ* 2021; 39: 139.
 29. Shorey S, Ang E, Yap J, et al. A virtual counseling application using artificial intelligence for communication skills training in nursing education: development study. *J Med Internet Res* 2019; 21: e14658.
 30. Tanioka T, Yasuhara Y, Dino M, et al. Disruptive engagements with technologies, robotics, and caring: advancing the transactive relationship theory of nursing. *Nurs Adm Q* 2019; 43: 313–321.
 31. Albrink K, Joos C, Schröder D, et al. Obtaining patients' medical history using a digital device prior to consultation in primary care: study protocol for a usability and validity study. *BMC Med Inform Decis Mak* 2022; 22: 189.
 32. Brandberg H, Kahan T, Spaak J, et al. A prospective cohort study of self-reported computerised medical history taking for acute chest pain: Protocol of the CLEOS-Chest Pain Danderyd Study (CLEOS-CPDS). *BMJ Open* 2020; 10: e31871.
 33. Almario CV, Chey W, Kaung A, et al. Computer-generated vs. physician-documented history of present illness (HPI): Results of a blinded comparison. *Am J Gastroenterol* 2015; 110: 170–179.
-