Making knowledge clips with patients: What learning mechanisms are triggered in medical students?

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ABSTRACT

Objective: To prepare medical students for a rapidly changing healthcare landscape, where new means of communication emerge, innovative teaching methods are needed. We developed a project-based learning course in which medical students design audiovisual patient information in collaboration with patients and with students in Communication and Information Sciences (CIS). We studied what learning mechanisms are triggered in medical students by elements of a project-based-learning course.

Methods: In this qualitative study, twelve sixth year medical students that participated in the course were individually interviewed. Data were analyzed according to the principles of qualitative template analysis.

Results: We identified four learning mechanisms: Challenging assumptions about patients' information needs; Becoming aware of the origin of patients' information needs; Taking a patient's perspective; Analyzing language to adapt to patients' needs. These learning mechanisms were activated by making a knowledge clip, collaborating with patients, and collaborating with CIS students.

Conclusion: Collaborating with patients helped students to recognize and understand patients' perspectives. Working on a tangible product in partnership with patients and CIS students, triggered students to apply their understanding in conveying information back to patients.

Practice implication: Based on our findings we encourage educators to involve patients as collaborators in authentic assignments for students so they can apply what they learned from taking patients' perspectives.

1. Introduction

Patient education is an essential component of person-centered care, since it enables shared decision making and fosters relationships characterized by trust and respect [1,2]. Patients increasingly use digital resources to obtain health-related information, for instance social media like Youtube videos or social networking sites [3,4]. Digital patient education tools like videos, can increase patients' knowledge, decrease anxiety and lead to positive behavioral change [5]. Healthcare providers play an important role in patient education, they "*serve as the proverbial spider in a web of health information*" [6]. To inform patients in a way that fits their needs means healthcare providers also need to be able to guide and support patients in the use of digital education tools [6]. New means of communication emerge rapidly in response to a changing healthcare landscape in combination with technological innovations [7,8,9]. Even though the current generation of medical students and residents grew up in an age of technology, they still need training on how to transfer their digital skills to medical practice [10,11]. A survey study showed that (future) healthcare professionals feel insufficiently trained with regard to digital health [12,13]. Therefore, we need to educate future healthcare providers to adjust flexibly to changes in digital healthcare in order to optimize their communication with patients [6].

Involving patients in the education of medical students aims to enhance person-centered care and communication [14]. Outcome-based

studies of educational initiatives with patients involved show promising results: learning with patients can enhance students' understanding of illness, empathy and communication skills [14–17]. More specifically, outcome-based studies where students provide patient education to real patients show that it can enhance students' patient education skills and their relationship with patients [18]. Following these promising results, a next step is to identify *how* students learn with patients, to inform the design and implementation of educational initiatives involving patients.

De Groot et al. made an important step in elucidating the process by which students learn with patients. In their realist review on patient involvement in medical education, they identified mechanisms through which students learned about patient-centeredness, like broadening perspectives and engagement with patients [19]. However, from the available literature, they were unable to determine how specific intervention components affected the learning process [19]. Therefore, with this study we aim to expand the findings of de Groot et al., by identifying learning mechanisms and by relating them to specific elements of a newly developed course.

Moreover, most of the educational initiatives with patients involved described in literature are encounter-based initiatives where patients share their experience or teach clinical skills, such as history-taking or physical examination [16,20]. Yet, to prepare students for working in an environment where new means of communication will keep emerging, innovative teaching methods are needed alongside these more traditional approaches.

We developed a project-based learning (PjBL) course, where medical students cooperate with patients and students of Communication and Information Sciences (CIS) in developing audiovisual patient information. PjBL is a form of situated learning, where students learn by engaging in authentic activities and work on real-life problems [21]. PjBL fits in a socio-constructivist learning approach: students gain a deeper understanding by actively constructing and reconstructing knowledge from experiences and social interactions [21]. In general, this approach aims to stimulate creative and critical thinking skills, and a mindset for problem solving and innovation [22]. Key features of PjBL are: students work on real problems or questions, in authentic environments, by collaborating with teachers and/or community members, activities are scaffolded and students create tangible products [21,22]. Examples of a PjBL approach are often seen in science and engineering education at primary and secondary schools levels, with positive effects on students' academic achievement [23]. However this approach is rarely described in medical education.

This study aims to understand how medical students learn from patients in a PjBL course. More specifically, we aim to obtain insight in what learning mechanisms are triggered by specific elements of PjBL. We define learning mechanisms as students' reactions to the opportunities provided by the course [24]. These reactions are usually hidden, sensitive to variations in context, and generate learning outcomes [24, 25]. In other words, learning mechanisms describe how students engage in learning activities and explain how an educational intervention works.

Thus, our research questions are: What learning mechanisms are activated in medical students in a project-based-learning course where patients actively participate? By what elements of the project-based learning course are these learning mechanisms triggered?

2. Methods

2.1. Study context: patient-centered, project-based learning course

A team of educators (n = 5), patients (n = 2), doctors (n = 2) and a student (n = 1) developed an interprofessional course called CLIKCS: Co-creating onLine Information Knowledge Clips for Society. In this elective course sixth year medical students designed knowledge clips containing audiovisual patient information in the topic of congenital heart diseases, in collaboration with patients and bachelor-level CIS students. The

learning goals for medical students were: identifying a patient's information need, creating understandable information, and collaborating with patients and CIS students.

The course setup was based on PjBL: a teaching method in which students collaborate with peers or other professionals, in a real-life context, to create an end-product in response to an authentic question or problem [21]. The course lasted for six weeks (see Fig. 1). Participants formed groups consisting of two medical students, one patient and one CIS student. Patients or their parents (in case of minors) were recruited through a patient organization dedicated to congenital heart diseases. For the sake of consistency, both patients and parents will be referred to as patients in this paper. The end-product of the project was an informative knowledge clip. The topic for the knowledge clip was determined during the first meeting with the patient and was based on a real question from the patient. Subsequently, the medical students developed a storyboard on which they received feedback from the patient and the CIS student. Finally, the medical students created the knowledge clip. See Appendix 1 for a detailed course description.

2.2. Sample

All twelve medical students who took part in the CLIKCS course in February 2019, participated in this study. Students were in their final year of medical school at Utrecht University. To ensure anonymity, and for the sake of clarity, all students in this paper will be referred to as 'she', and all patients will be referred to as 'he'. For the sake of brevity, medical students will be referred to as students from this point on.

2.3. Data collection

Students were interviewed individually at Utrecht University, see Appendix 2 for the interview protocol. The semi-structured interviews lasted on average 45 minutes. The first two interviews were conducted by both interviewers (MK, JW) to get acquainted with the protocol and to ensure that subsequent interviews were conducted similarly and comparably. The ten remaining interviews were divided between the two interviewers. The interviews were audio recorded and transcribed verbatim.

2.4. Ethical approval

Written informed consent was obtained prior to enrolment in the study. Ethical approval of this study was provided by the Dutch Association for Medical Education (NVMO, NERB file number: 2019.1.4).

2.5. Data analysis

Data was analyzed using NVivo 12 (QSR International, Burlington, Massachusetts). We performed a template analysis, which is a form of thematic analysis [26]. Starting with a priori codes, we applied a sequence of continuously modified templates to the data set throughout the analysis. A priori codes were based on features of PjBL in the CLIKCS course (cooperation with patient, cooperation CIS-student, making knowledge clip, authentic environment, real problem). We took an open approach to identify learning mechanisms.

CE and MK iteratively applied the a priori template to the 12 transcripts, whilst refining and adding codes. Subsequently, the adjusted coding template was discussed with researcher RK and the mechanism codes were further refined. The final coding template, see Appendix 3, was applied to all interview transcripts by either CE or MK.

Lastly, we sought relationships between course elements and mechanisms. By close reading of the text around the mechanism codes, we identified by which elements of the course students' learning mechanisms were triggered. We were able to relate mechanisms to the following course elements: cooperation with a patient, cooperation with a CIS student, and making a knowledge clip. Interpretations were
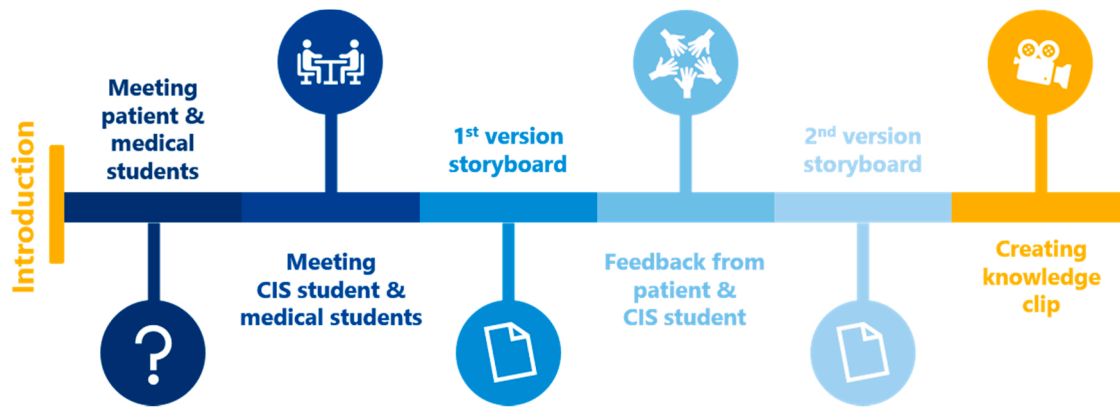
Fig. 1. Course design: Patient-centered, project-based learning course. CIS student = student Communication and Information Sciences.

discussed with the entire research team and consensus was reached about the final interpretation.

2.6. Reflexivity

To enhance reflexivity during the research process, assumptions and interpretations of the data were discussed during research team meetings. The team comprised of clinicians, educators, educational researchers, a student and a patient. This combination of backgrounds helped us to assess the data from different perspectives. CE and JF are both medical doctors and were involved in the development of the educational course where this study took place. At time of this research, MK was a master student in Science Education and Communication at Utrecht University. MK did not know the participating students personally. RK and MS are educational researchers. RJ is an advisor on patient involvement in medical education, she has lived experience as a mother of a child with a congenital heart disease. JW is an educator in the field of communication and clinical skills.

3. Results

We identified four learning mechanisms: Challenging assumptions

about patients' information needs; Becoming aware of the origin of patients' information needs; Taking a patient's perspective; Analyzing language to adapt to patients' needs. These learning mechanisms were activated by three course elements: Cooperating with a patient, Cooperating with a CIS student and Making a knowledge clip. We were unable to relate the course elements Authentic environment and Real problem directly to one of the mechanisms. See Fig. 2 and Table 1.

We first discuss how students perceived the course elements, then we elaborate on the learning mechanisms and how these were triggered.

3.1. Students' perspectives on course elements

3.1.1. Cooperation with patient

Students enjoyed cooperating with a patient, they considered the patient's knowledge as legitimate, and took his feedback seriously. Students recognized that the patient's contribution had great value for making the knowledge clip. "If [medical student] and I had made the video ourselves, it would have been a reasonable video. But in the end, it became a warm and compassionate video because of the communication student and the patient."-St 2.
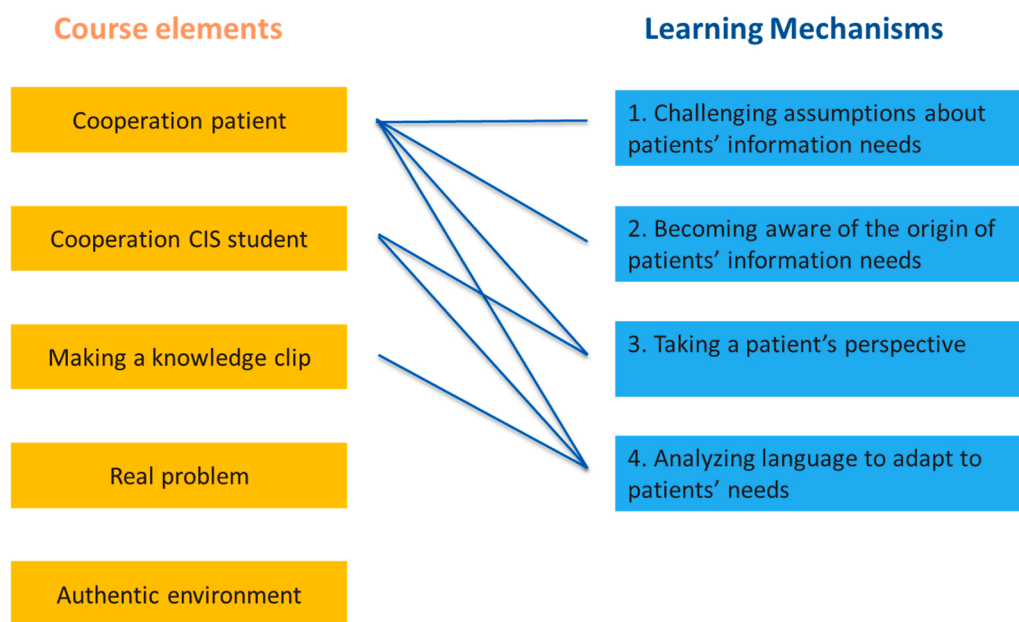

Fig. 2. Course elements and learning mechanisms. CIS student = student Communication and Information Sciences. The lines indicate which course elements activated which learning mechanisms. We were unable to relate the course elements Real problem and Authentic environment to the specific learning mechanisms.

Table 1

Explanation of how course elements triggered learning mechanisms.

Learning mechanism	Course element		
	Cooperation patient	Cooperation CIS student	Making knowledge clip
Challenging assumptions about patients' information needs	• Students explored topics for the knowledge clip by discussing information needs with patients • This made students became aware of patients' information needs, which challenged their previous assumptions		
Becoming aware of the origin of patients' information needs	• Students explored the information needs of a patient through informal discussion with a patient • This made student became aware of the story behind an information need (the origin of an information need)		
Taking a patient's perspective	• Patients provided feedback on the knowledge clips from their perspective • Engaging with this feedback made students to think from a patient's perspective	• CIS students provided feedback on the knowledge clips from their perspective • Engaging with this feedback made students to think from a layman's perspective	
Analyzing language to adapt to patients' needs	• Patients provided feedback mainly on the content of the knowledge clip, the level of difficulty and the emotional impact which words or images can have on them • Engaging with this feedback made students analyze their language	• CIS students gave communicative advice and provided feedback mainly on a textual level (use of jargon, word choice, syntax) • Engaging with this feedback made students analyze their language	• Students developed a knowledge clip to answer a patient's question and applied feedback from a patient and CIS student during this process • This stimulated students to analyze their language and make deliberate choices about words, images, and the storyline

CIS student = student Communication and Information Sciences

3.1.2. Cooperation with CIS student

Students also enjoyed cooperating with the CIS student. Most students mentioned that the CIS student added value to the project and helped them to convey the message and build a story. Yet, three students questioned the value of the CIS student. They mentioned that any lay person could have given the feedback they received from the CIS student, or that they would have come to the same conclusions themselves. "Her points didn't really add value to me. We had a relatively easy subject. I might have gotten the same tips from a lay person." –St7 Notably, these three students all worked in different groups, their direct peers did consider the CIS student valuable.

3.1.3. Making the knowledge clip

Students enjoyed the creative part of making a tangible product, but they also mentioned it was time consuming and sometimes even frustrating. Especially creating and editing with animation software took a significant amount of time. Students had never made a knowledge clip before participating in this course. They mentioned they would have wanted more guidance in choosing the right software program and receive training on how to use this software.

3.1.4. Authentic environment and real problem

In line with the design of PjBL, students experienced an authentic context. They described that they were making an actual product, in response to a real question, that could be used by real patients. Getting to know the patient who proposed the subject of the knowledge clip, made it even more real for them. Several students explicitly described that their goal was to satisfy the patient with the knowledge clip. *"You're really doing it for someone. Someone has a question and that's why you're making this video. You are doing it for someone." -St7.*

3.2. Learning mechanisms and how these were triggered by course elements

We identified four learning mechanisms that were triggered by the course elements.

3.2. 1. Challenging assumptions about patients' information needs

Firstly, students' assumptions about information needs of patients were challenged. Patients often proposed questions and topics for the knowledge clip that were different from what the students had expected. "He actually came up with practical questions, while we were thinking about information on medical disorders. For example, he wanted to know how a feeding tube works. How does a ventilator work? How to find your way in the hospital? Sometimes these questions play a more important role than which blood vessel is not properly developed."-St7.

This learning mechanism was triggered by the course element Cooperating with the patient as depicted in Fig. 2, Table 1. Students were instructed to ask the patients what they wanted to know and to use this as the topic of their knowledge clip. By exploring topics for the knowledge clip together with the patient, students became aware of patients' information needs.

3.2. 2. Becoming aware of the origin of patients' information needs

Secondly, students became aware of the origin of patients' information needs. Students learned about the story behind a certain information need. So, in addition to the first learning mechanism which addressed *what* the information need was, this mechanism concerns *why* patients had certain information needs and how certain information could help patients. "And [the parent] spoke from his personal experience, that everything happened very fast after the baby was born and was taken care of by the pediatrician. No time to take pictures, really. So that was very clear: [the parent] would have wanted to know that in advance, because it just goes very fast. That would have given him [the parent] more peace and quiet."-St1.

Just as the first learning mechanism, this mechanism was triggered by Cooperating with the patient, see Table 1.

3.2. 3. Taking a patient's perspective

Thirdly, students strived to take a patient's perspective. They actively tried to think from a patient's point of view. "Yes, I think so, because you are truly focused on the patient, while, during the first years of medical school, you are more focused on theory and books. During your clerkship you are obviously focused on patients, but now you… you really need to place yourself in the patient's shoes, and also really, as came up with the communication student: how do you communicate well? Yes, you can explain things in a medical way, but then the patient still doesn't understand." -St10.

This was triggered by Cooperating with the patient and by Cooperating with the CIS student, see Table 1. CIS students did not only give

medical students advice on their communication, but also provided them a laymen's perspective. Since the CIS students did not have any medical knowledge, they were sometimes even more 'lay' than the patients, who had already learned about their disease over the years. "The expertize was mainly that she had zero medical knowledge. This makes you take the perspective of patients who don't have this knowledge yet. That helped. As a medical student you quickly assume that something makes sense, when it doesn't at all." -St8.

3.2. 4. Analyzing language to adapt to patients' needs

Lastly, students analyzed the language they used to adapt it to patients' needs. They examined their use of jargon, the sequence of explaining, the level of difficulty, and the effect certain words can have on patients. "Especially the difficulty level and in terms of text. The heart has different chambers, namely … We discussed this from the very beginning. So the words we used, the largest artery in the body, you know, that sort of things we named differently. You wouldn't say that in med school. So we started to simplify a lot. And a lot of background information: starting with the basics and trying to keep it as simple as possible. That was quite difficult. So with that, we mainly thought about the target group."-St3.

This learning mechanism was triggered by Cooperating with the patient, Cooperating with the CIS student, and by Making the knowledge clip, see Table 1. Answering a question of a patient through a knowledge clip, required students to make deliberate choices about words, images and the storyline. CIS students provided medical students with feedback mainly on a textual level (use of jargon, word choice, syntax). Patients provided students with feedback mainly on the content, level of difficulty, and the emotional impact which words or images can have on them. Applying this feedback made students analyze their language and helped them to tailor it to the patient's needs. "We came quite far without the help of the communication student and the patient. But these are just very essential details that they point out to us. Sometimes we were not aware of that at all. Information may come across in an unintentional way or is too difficult to understand. That is very important." -St2.

4. Discussion and conclusion

4.1. Discussion

In this qualitative interview study we explored medical students' learning process in a PjBL course where they made audiovisual patient information in cooperation with patients and CIS students. Our results suggest that specific elements of PjBL activated four learning mechanisms in medical students. Cooperating with a patient, cooperating with a CIS student, and creating a tangible product in an authentic context made students: (1) Challenge assumptions about patients' information needs, (2) Become aware of the origin of patients' information needs, (3) Take a patient's perspective and (4) Analyzing language to adapt to patients' needs.

The first three learning mechanisms fit within the clusters of mechanisms related to patient-centeredness as identified by de Groot, namely the clusters 'comparing and combining as well as broadening perspectives' and 'developing narratives with patients' [19]. We add to the review of de Groot by connecting these mechanisms to specific course elements of a PjBL. Moreover, we found an additional learning mechanism: Analyzing language to adapt to patients' needs.

The additional learning mechanism Analyzing language was triggered by making the knowledge clip in collaboration with a patient and a CIS student. A core-element of PjBL is making a tangible product. In this course, students made audiovisual patient-information. When informing patients it is important to firstly understand what the patient needs to know, and secondly how to convey this information [27–29]. The first three learning mechanisms (Challenging assumptions about the information needs of patients, Becoming aware of the origin of patients'

information needs and Taking patients' perspectives) aid in understanding what a patient needs to know. Next, one needs to use his gained understanding of a patient's perspective in communicating back to this patient [30]. This requires skills in offering understandable explanations, framing information, and using visual aids where appropriate, all aligned to the patient's needs [2]. The new learning mechanism, Analyzing language, went beyond simply recognizing jargon, it included analyzing the level of difficulty, the sequence of explaining, and the emotional impact certain words can have. Therefore, we reason that this mechanism is supportive of conveying information back to patients, and thereby is distinct from the first three learning mechanisms.

Other studies on educational interventions with patients involved, mainly report learning mechanisms supportive of gathering information: listening, recognizing information needs and perspective-taking [31–39]. However, as argued by Coulby et al.: *'what we want students to gain from their experience of patient involvement in education, it actually goes far beyond the "patient perspective."'* [40]. The additional learning mechanism shows that students went beyond understanding the patients' perspective by communicating back to them, which was triggered by making the knowledge clip in collaboration with the patient and the CIS student. Our study therefore emphasizes the value of a project-based course design, where students work on a concrete task together with patients.

The learning mechanisms Challenging assumptions about patients' information needs, Becoming aware of the origin of patients' information needs, and Taking perspective show that, through cooperating with patients, students reconstructed prior knowledge and gained a deeper understanding of patients' information needs and perspectives. These findings confirm the constructivist base of PjBL, namely that individuals construct and reconstruct knowledge through experience and social interaction [41]. Other studies also report that, through interaction with patients, students questioned their previous assumptions [19,34,37,39], and broadened their understanding of patients' perspectives on healthcare and living with disease [19,32,33,35,37,38]. This emphasizes the importance of designing educational interventions where students interact with patients, and thereby learn *with* and *from* instead of just *about* patients.

Interestingly, the learning mechanism Taking a patient's perspective was not only triggered by collaborating with patients. Cooperating with CIS students also made medical students think from a patient's perspective. Where patients in this course had often already acquired a fair amount of medical knowledge throughout their patient journey, the CIS students offered a true lay perspective. This activated medical students to think from a perspective of new patients who often still have limited medical knowledge. So, it seems that working with lay people, who are not necessarily patients, on a patient-centered task, also contributes to understanding and adjusting information to patients' information needs. Perspective-taking can also be seen as an outcome of person-centered education, since understanding a patient's perspective is an element of clinical empathy [42]. Yet, in this study we conceptualize perspective-taking as a mechanism for communicating with a patient. As mentioned before, to communicate effectively one needs to understand what a patient needs to know [27–29].

It is important to bear in mind that we did not measure whether the learning mechanisms led to specific learning outcomes. However, we reason that students became more patient-centered, since the first three learning mechanisms are similar to the mechanisms related to patient-centeredness described by de Groot [19]. Especially since de Groot described that these mechanisms were elicited in the context of legitimate participants, and students in our study also considered the patient's input legitimate and valuable [19]. The fourth learning mechanism, Analyzing language, is additional to the findings of de Groot. We reason that it contributes to patient-centered communication. A review by Van Vijn et al. showed that students' communication skills and relationships with patients improved by providing patient information [18]. However, it is unknown whether this was due to Analyzing

language.

Second, we did not measure if students retained what they learned over an extended period of time and whether they are inclined to use it in practice, as few other studies on patient-involvement have done [14–16,20]. As such, the long-term retention and transfer of skills to practice could both be a subject of future study.

Lastly, the students in our study voluntarily signed up for the course. They were highly motivated to participate and to work with patients. Whether this course stimulates similar learning mechanisms in a more heterogeneous group of students, including students who are possibly less motivated needs to be explored in future research.

4.2. Conclusion

This study showed that a PjBL course where medical students cooperated with patients and CIS students in making audiovisual patient information, activated awareness and understanding of patients' information needs and patients' perspectives. Working on a tangible product in partnership with a patient and a CIS student, provided students with the opportunity to apply this understanding when informing patients.

4.3. Practice implications

For teaching practice, we suggest involving patients in medical education as true collaborators, beyond just sharing their perspective. We encourage educators to use innovative methods such as PjBL and to involve patients in authentic teaching assignments, where students can apply what they learned from taking patients' perspectives. For research, the next step is to study the (long-term) effects of educational interventions with patients involved and their transfer to practice, in a more heterogeneous group of students.

Declaration of interest

The authors declare no conflicts of interest.

Acknowledgments

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2022.06.008.

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