



# Physiotherapy Students' Experiences with Clinical Reasoning During Clinical Placements: A Qualitative Study

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## Abstract

**Background:** Clinical reasoning skills are considered to be among the key competencies a physiotherapist should possess. Yet, we know little about how physiotherapy students actually learn these skills in the workplace. A better understanding will benefit physiotherapy education.

**Objectives:** To explore how undergraduate physiotherapy students learn clinical reasoning skills during placements.

**Design:** A qualitative research design using focus groups and semi-structured interviews.

**Setting:** European School of Physiotherapy, Amsterdam, the Netherlands.

**Participants:** Twenty-two undergraduate physiotherapy students and eight clinical teachers participated in this study.

**Main outcome measures:** Thematic analysis of focus groups and semi-structured interviews.

**Results:** Three overarching factors appeared to influence the process of learning clinical reasoning skills: the learning environment, the clinical teacher and the student. Preclinical training failed to adequately prepare students for clinical practice, which expected them to integrate physiotherapeutic knowledge and skills into a cyclic reasoning process. Students' basic knowledge and assessment structure therefore required further development during the placements. Clinical teachers expected a holistic, multifactorial problem-solving approach from their students. Both students and teachers considered feedback and reflection essential to clinical learning. Barriers to learning experienced by students included time constraints, limited patient exposure and patient communication.

**Conclusions:** Undergraduate physiotherapy students develop clinical reasoning skills through comparison of and reflection on different reasoning approaches observed in professional therapists. Over time, students learn to synthesise these different approaches into their own individual approach. Physiotherapy programme developers should aim to include a wide variety of multidisciplinary settings and patient categories in their clinical placements.

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## 1. Introduction

Clinical reasoning skills are considered to be among the key competencies a physiotherapist should possess.<sup>1–3</sup> This dynamic and cyclical process of clinical reasoning enables health care professionals to “take ‘wise’ action”, in other words: make the best judgment under specific circumstances, in relation to patient and context.<sup>4</sup> Within this clinical reasoning process, physiotherapeutic treatment forms an integral part.<sup>1,5</sup> Most frameworks on clinical reasoning in physiotherapy are derived from literature on medical education, since there are a lot of similarities in approach.<sup>1</sup> Research on clinical reasoning in health professions education has hitherto focused on the cognitive processes underlying decision-making and the accuracy of decisions,<sup>6,7</sup> educational strategies to improve clinical reasoning<sup>8–10</sup> and assessment.<sup>11,12</sup> In physiotherapy, clinical reasoning is based on the principles of Evidence-Based Practice. Undergraduate students are taught to make explicit and conscientious use of current best evidence (based on systematic research) underlying joint decision-making with the client.<sup>5</sup> Evidence states that incorporating patients’ needs and experience in the clinical reasoning process is key to physiotherapy students’ development of clinical reasoning<sup>13</sup>.

Looking into expertise development in clinical reasoning, we find accumulating evidence in the healthcare literature on the importance of existing concepts and models of clinical reasoning, such as the International Classification of Functioning, Disability and Health: ICF framework.<sup>14</sup> This model is following a methodical approach of reasoning, based on information gathering, formulating and testing preliminary hypotheses, thus generating clinically relevant conclusions. Riddle and Stratford<sup>7</sup> compared this model to the hypothesis-oriented approach or HOAC II. This algorithm provides a more evidence-based framework for clinicians. The HOAC II can be used for documentation and clinical decision-making, at the same time actively involving the patient in shared decision-making,<sup>7,15</sup> and is commonly used in physiotherapy practice. To support students’ development of clinical reasoning skills, clinical educators also make use of clinical prediction rules<sup>16</sup> or existing guidelines for practice. However, there is a paucity of research on development of clinical reasoning skills in the field of physiotherapy.

Several authors have described educational strategies promoting development of clinical reasoning in

medical education,<sup>8,9,17</sup> indicating that the learning of clinical reasoning can only take place to a certain extent within the preclinical phase, as its application is bound to real-life context. When considering workplace-based learning from a theoretical point of view, we find that experiential learning theories are based on three assumptions: 1) learning is ‘situated’; 2) learning can be viewed either as an individual or a collective process, to which interactions are fundamental, and 3) learning is triggered by authentic practice-based experiences.<sup>18</sup> All this is true for undergraduate physiotherapy education, which relies heavily on experiential learning,<sup>18</sup> with clinical placements forming the backbone of the undergraduate curriculum. On placement, students are confronted with patient problems and learn how to practise their clinical reasoning skills in a real-life context. Explicit teaching of clinical reasoning skills, thereby helping improve diagnostic accuracy and justification of treatment choices, facilitates students’ learning of clinical skills in the workplace<sup>19</sup>.

According to the principles of experience-based learning,<sup>20</sup> observing, rehearsing and contributing are important processes of learning in practice. Moreover, the learning environment must be supportive,<sup>20,21</sup> allowing students to safely participate in practice,<sup>18,22,23</sup> aiming to match available learning opportunities to different learners’ developmental levels.<sup>24</sup> Research related to clinical education in physiotherapy private practice is limited<sup>25,26</sup> and evidence describing clinical workplace learning has concentrated more on clinical teaching than on learning.<sup>20</sup> Thus, it remains unclear how the clinical learning environment facilitates or inhibits students’ development of clinical reasoning skills.

This study explores physiotherapy students’ and clinical teachers’ experiences with students’ learning of clinical reasoning skills. Although support from clinical teachers may vary from observing performance of partial tasks under supervision (first and second year students) to providing feedback on independent work activities (third and fourth year students), we believe that clinical reasoning forms an essential part of students’ individual learning trajectory throughout different stages of undergraduate physiotherapy training.<sup>2,4</sup> Therefore, a qualitative, cross-sectional research design was employed to address the following questions: (1) How do undergraduate physiotherapy students develop clinical reasoning skills during clinical placements? (2) Which factors facilitate or inhibit this development?

## 2. Methods

### 2.1. Setting

This study was set in the European School of Physiotherapy (ESP), which offers a Bachelor of Science (Hons) degree in physiotherapy at Amsterdam University of Applied Sciences, the Netherlands. The regular four-year programme comprises three clinical placements spanning ten, twenty and fifteen weeks during year 2, 3 and 4, respectively. Two of these placements must be spent abroad; only one out of three may be completed in the Netherlands. Students receive supervision from a staff member who, together with their clinical teachers, evaluates their performance before completing the final grading of the clinical placement.

### 2.2. Design

We applied a qualitative exploratory design, using focus groups to explore students' experiences<sup>27</sup> and semi-structured interviews to individually explore teachers' experiences. The discussion guide for focus groups was piloted and discussed in the research team. The questions were then adapted further by the team for the individual interviews with the clinical instructors, based on focus group findings (see [Appendix A and B](#)). All interview sessions were recorded and transcribed verbatim, after taking informed consent. To ensure rigour, the research team kept an audio trail of the process, including a reflexivity diary.

### 2.3. Participants and procedures

We employed a purposive sampling<sup>28</sup> technique, including both Dutch and international students from year 2, 3 and 4 of the ESP programme, who had completed minimally one placement in a private practice setting ([Appendix C](#)). This allowed for comparison of contextual factors between both groups. All students meeting the inclusion criteria ( $n = 46$ ) received a personal invitation by email, containing an information letter and informed consent form. Twenty-two students (48%) volunteered to participate in our study, representing 10% of the total number of ESP students. Participants joined one of 4 focus group sessions, which lasted between 60 and 90 minutes. Group sizes ranged between 3–8 student participants and were matched to represent different year groups ([Appendix C](#)). TB facilitated all group sessions, with MW taking field notes. All focus group sessions were directly followed by peer debrief, involving MW and TB present.

After the focus group interviews, MW sampled a wide range of clinical teachers from private practices in the Amsterdam region ( $n = 17$ ) affiliated with the ESP programme; first by personal email invitation, then by phone contact. Eight clinical teachers (47%) consented to voluntarily participate in individual semi-structured interviews, which were conducted by MW and lasted between 20 to 30 min. Interviews were audio recorded for transcription, whilst field notes were taken during the sessions. Based on their background and experience we consider these clinical teachers representative in physiotherapy approach and years of clinical experience for all clinical teachers based in The Netherlands.

### 2.4. Ethics

Ethical approval for this study was obtained from the Ethics Committee of the Netherlands Association for Medical Education (NVMO) under reference number 00562. All participants signed informed consent after reading the information letter provided, before data collection started.

### 2.5. Data analysis

We performed a thematic analysis of the transcripts<sup>28</sup> in an iterative process. Coding of the first focus-group session by two researchers yielded an initial template for analysis, which was consequently critically discussed in and further refined by the entire research team. The first author then used this refined template to code all focus-group transcripts. The initial analysis of focus group results informed the questions for the semi-structured interviews ([Appendices A and B](#)). MW then analysed the individual interviews, before discussing additional findings with the team. The sample size allowed for thematic saturation: no new themes occurred during the last interviews. From the codes and categories, which were discussed in the research team, three significant themes emerged (see [Appendix D](#)). A member check was performed involving group representatives' proofreading our draft results, informing small adaptations to the final paper.

## 3. Results

Thematic analysis of interview data led to the emergence of three significant themes related to students' workplace learning of clinical reasoning skills: (1) the learning environment, which involves the clinical setting, local health care team and patient-related activities; (2) the role of the clinical teacher, directly

supervising the student; and (3) individual students' development of clinical reasoning. In the next paragraphs, interview quotes from students (S) or clinical teachers (CL) elucidate each theme, with their individual participant number included in parentheses.

### 3.1. The learning environment

Students reported that the quality of the learning environment largely dictated whether or not they had a positive learning experience during clinical placement. As they venture worldwide for their clinical internships, they found that differences in local health care regulations corresponded to international differences in learning environments: for example screening procedures related to direct accessibility, which is common in The Netherlands, would not be found elsewhere: *'Like I saw in my first internship in France, where there was no direct access. The (local) students had way better skills than me, they could perform some real fancy treatment, but in the end they didn't really think about the whole patient; their clinical reasoning was limited.'* (S14) Also time reserved for patient treatment, intern's responsibilities and the quality of practice, for instance, differed across contexts: *'The health care system is a big contributor: are there twenty, thirty minutes, or even an hour reserved for physiotherapy? Is there money; is there a good facility? (What about the) standard of physiotherapy?'* (S18) Working in a team of (multi-disciplinary) professionals enhanced students' learning experience, as it afforded students the opportunity to observe and reflect on the various approaches to clinical reasoning used by clinical teachers or other health care specialists. Students valued being part of a larger team, especially when including peers: *'Because at some point, at the end of the day, even if you are not all the time together, you talk about what you did and why. And I mean it's more easy to talk than with your clinical instructor, (because) with someone who is on the same level you are more open.'* (S21) Obtaining multiple perspectives on problem solving by means of case-based discussions, comparing findings with the clinical teacher or other professionals, all positively contributed to students' development of clinical reasoning: *'Especially because there are so many different areas: different physiotherapist have different approaches and a lot of these seem to work.'* (S9).

The position of the intern within the healthcare facility was found to be of great importance for successful development of clinical reasoning skills, as this requires freedom to try and act independently, mutual trust and open communication between student and supervising

team: *'If you have a basis of trust and you are allowed to make mistakes and they show that they want to try and educate you, this is a good combination to learn.'* (S8).

Both students and clinical teachers stated patient exposure was key in development of clinical reasoning skills: *'Students need 'practice hours' to learn their profession and become flight captain.'* (CT6) Students learnt most when they could test their own clinical reasoning approach on individual patients in real-life practice: *'Your clinical instructor can discuss with you until Kingdom come, but it is just not the same as doing it on your own'* (S19). Repetition, increased practical experience and exposure to a wide variety of complex patients helped students develop and solidify their own approach, building towards pattern recognition: *'When you follow certain diseases for a long time, you start to think in patterns. And then you realise: 'o, this might be connected to that', so instead of thinking 'why' you will already associate about the underlying cause.'* (S16).

Students and clinical teachers agreed that a critical attitude should be developed during the preclinical phase of education, to support an active learning style and integration of evidence-based practice. Contextualised preclinical learning, for example practising manual skills in relation to case-based learning, supported developing an individual approach before entering clinical practice: *'If you have no idea how to approach the problem or what to assess, you will not be able to ask the appropriate questions.'* (CT5) Clinical teachers asserted that more simple or complex patient categories and different practical settings required equally different clinical reasoning processes. It follows that a student's proficiency in clinical reasoning is largely defined by the affordances of the practical setting and complexity of patient categories encountered during clinical placements, although in essence the process comes down to: *'peeling all layers away until you come to the core.'* (CT8).

While some students found difficulty adapting to a new work routine, or managing goals and expectations, others experienced difficulties connecting their preclinical knowledge and skills to actual practice, particularly during the first clinical placement: *'I never got a chance really to put into practice exactly what we learn in school.'* (S4) Both students and clinical teachers mentioned a number of potential workplace-related barriers to successful learning, such as: disproportionate service demands, caused by understaffing or a lack of patients; (national) regulations not providing for adequate physiotherapy assessment or not allowing students to diagnose patients; or time constraints preventing supervision or reflection. *'You can have too few patients but*

you can also have too many patients which obstructs your learning process.’ (S22).

### 3.2. The role of the clinical teacher

During physiotherapy placements, students received one-on-one supervision from senior therapists. Clinical teachers who adopted an open attitude towards the student, explicated their own thought processes and provided feedback regularly were appreciated most by students: *‘He got us to watch what he was doing and explained his reasoning along the way, but then wanted us to just try things out that were within our scope and see how these would work or if they must be changed.’* (S7) According to the students, it is helpful when clinical teachers start the reasoning process, integrating the students’ previous knowledge to support clinical decision-making, by focusing on the connection between elements of the process to create a more natural flow: *‘In school, we learned patient history, assessment and treatment as separate subjects to which we applied clinical reasoning separately, whereas my clinical instructor focused on making it an on-going process.’* (S3) Clinical teachers used different strategies to support individual student’s learning, depending on the level of support needed, such as: pointing out gaps in students’ knowledge, encouraging them to participate and to reflect on the learning process: *‘Different students have different needs; some you can quickly allow more freedom to practice, whereas others need more external structure to go by or are advised to repeat their practical skills with peers before performing on patients.’* (CT7).

All teachers favoured ‘learning-by-doing’ and agreed it is important to stimulate self-reflection in students by means of indicating gaps in physiotherapeutic knowledge, providing structure and feedback, and encouraging exploration: *‘She left me completely free in everything and then, later on, she would discuss it with me and compare approaches.’* (S22).

Students agreed that their development of clinical reasoning skills grew not only by shadowing their clinical teacher, but also by participating actively in practice: *‘The first part of my internship he would just watch me, give me things to do, to become more independent. Then, he would show me his way of thinking, explain me his process of reasoning. Finally he would let me integrate things, so that at the end I did way more with him on the side to guide me.’* (S3) Clinical teachers fostered students’ development by providing regular feedback on performance, asking critical questions about their clinical reasoning to

help structure their thoughts, and approach patient problems more holistically: by taking the patient context into account when interpreting clinical findings from patient assessment students would be better able to solve complex and often multifactorial problems: *‘Students have trouble connecting the dots when there’s a person in front of them.’* (CT1).

Students informed that their individual development of clinical reasoning skills depended greatly on the personal rapport they had with their clinical teacher, at the same time also emphasising the need to gain practical experience, in order to learn from their mistakes: *‘If you first get to see what (your clinical teacher) is doing you will try to do the same, whereas I could make mistakes and then know why because of her feedback.’* (S17) They believed it was their clinical teachers’ job to help them organise and connect the elements of the reasoning process to improve its logic, whereas insufficient encouragement of the clinical teacher restricted their learning: *‘Often (the clinical teacher) wouldn’t answer my question or confirm what I was doing was right, but only return questions. This created a feeling of uncertainty and tension that negatively interrupted my workflow.’* (S6) Students sometimes struggled to bridge the gap between theory and practice. Having to integrate practical findings with theoretical knowledge helped students to structure their clinical reasoning, for example when applying clinical guidelines in practice or filing patient data: *‘The reports are structured in such a way that when you’re writing things down it helps you to structure it right.’* (S8).

Students agreed mutual trust and confidence expressed by their clinical teacher was essential for learning clinical reasoning skills: *‘as an intern, do you feel that you are able to make mistakes? Is it a safe learning environment?’* (S12) The solitary nature of their profession means not all physiotherapists are able to receive feedback on this process or involve colleagues in case of doubt, creating the need to maintain an open and critical attitude towards clinical reasoning. Following a cycle of informed decision-making, evaluation and adjustment means that *‘only after closure you can draw your conclusion about the correctness of decisions made during the process.’* (CT5).

### 3.3. Individual students’ learning

Before being able to make any decision about physiotherapy practice, students need to acquire basic knowledge and skills. They considered clinical reasoning

the justification behind every therapeutic decision, or ‘... *the logic behind what you are doing.*’ (S7) Clinical teachers outlined how clinical reasoning relates to different thinking models, such as the biomedical model and the bio-psychosocial model. They also emphasized the importance of students developing a holistic perspective, based on the fact that individual patient complaints can be considered multifactorial problems: ‘*We (should not) forget there’s a human being in front of us and follow protocols instead.*’ (CT8) Students recognized that clinical reasoning should be focused on individual cases: ‘*Clinical reasoning is trying to give you a framework of how to deal with each patient, specifically tailored to every individual.*’ (S22).

Clinical teachers noted that all students initially showed knowledge gaps that needed mending before they were able to practise clinical reasoning on real patients: ‘*Provided you can rule out everything that hinders the cognitive process, you can pay full attention to clinical reasoning.*’ (CT6) As a remedy, they provided students with additional theoretical assignments or urged them to practise their manual skills more, together with other student interns, for example. Both teachers and final year students indicated that the simple act of putting things to practice would gradually raise the overall level of clinical reasoning: ‘*If you compare differences in students’ approach between the first placement and the last one you notice the overall development of clinical reasoning.*’ (CT2) They also agreed that ‘hands-on’ experience, or (independent) learning by trial and error, should be complemented by feedback on ‘mistakes’ and active self-reflection: ‘*You have to ask yourself otherwise you are just doing something without any logic.*’ (S5) Clinical teachers shared this view by indicating that critical, reflective students were the most proficient learners of clinical reasoning skills.

Students described different potential barriers to their learning process. Language barriers would sometimes complicate patient communication, inhibiting the learning process as students missed out on essential information: ‘*We had so many occasions where people would only speak the local dialect, which was really limiting the information I could receive directly from the patient.*’ (S4) Moreover, problems in communication with the clinical teacher or other health care professionals could negatively influence students’ self-confidence and learning abilities. Both students and clinical teachers agreed that a reflective attitude was indispensable: ‘*There’s a risk when your expertise increases a lot, that your clinical reasoning actually goes down a bit instead of rethinking and reapplying tests.*’ (S10) They considered clinical reasoning an

ongoing process, continuously changing as expertise grew and new evidence became available: ‘*As empirical evidence and research in physiotherapy will bring changes to the profession, you should be flexible and adapt your clinical reasoning accordingly.*’ (CT5).

To maximise their clinical reasoning skills, students must therefore learn to integrate professional knowledge, practical skills, clinical experience and evidence to arrive at a structured, yet flexible, individual patient approach. Over time students learnt to synthesise different approaches to clinical reasoning into their own approach. ‘*You pick the things that are important and you add something from your theoretical background, assimilating it into your own treatment strategy.*’ (S19).

In the end, both students and clinical teachers believed full mastery of clinical reasoning cannot be attained, even with increased expertise, since: ‘*you can always learn more*’ (S14) or, as one of the clinical teachers stated: ‘*I’m not sure whether I am perfect in clinical reasoning. I would love to learn.*’ (CT4). Although clinical teachers clearly made a distinction between simple and complex patient categories, finding your own structure or ‘flowchart’ is as close as you may probably get to master clinical reasoning: ‘*There are just so many options, so many choices you can make. It’s a process: you keep learning all the time, with every new patient you treat.*’ (S20).

#### 4. Discussion

On placement, undergraduate physiotherapy students develop clinical reasoning skills through practical experience, which is gradually increased. This development is influenced by repetitive clinical exposure to a wide variety of patients, enabling students to compare differences and similarities in approach. Student learning is further enhanced by individual feedback from the clinical teacher and reflection on the clinical reasoning process, either alone or, even better, together with the clinical instructor or with others. These results are consistent with theories on experience-based learning, confirming the principles of ‘supported participation’<sup>18,20</sup>.

We have found some discrepancies between students’ and teachers’ perceptions of how students develop their own approach in clinical reasoning. In the beginning, students still need to learn how to interpret and relate clinical findings in solving individual patient problems,<sup>29</sup> indicative of the struggle to integrate theoretical knowledge and practical outcomes into a more fluent reasoning process. Educational tools such as clinical guidelines help structure students’ thoughts during workplace-based

learning, supporting the systematic organisation of patient information.<sup>7</sup> Over time, students come to develop a certain structure, which bolsters confidence in their clinical reasoning, allowing them to work towards better integration of the context into their physiotherapy treatment. Clinical teachers, however, emphasise the importance of including the patient's context and perspective from the beginning, which is in line with previous findings<sup>29</sup>.

Multiple, equally acceptable approaches to clinical reasoning exist.<sup>11</sup> Our results indicate that students indeed develop their individual approach to clinical reasoning by actively exploring and comparing different approaches observed in professional therapists during placements. Although the necessity to adapt to the particular learning environment or demands of the workplace may influence this learning process, students also learn to combine strategies for better outcomes<sup>6</sup> throughout their placement career.

#### 4.1. Consequences for physiotherapy education

Our study confirms the notion that preclinical training does not sufficiently prepare physiotherapy students for their future workplace mission to integrate theoretical knowledge and practical skills into the dynamic process of clinical reasoning.<sup>4</sup> From our results we suspect this gap between classroom and workplace-based learning is widest during the first clinical placement, possibly due to a lack of clinical experience. These findings are in line with previous research, describing how “undergraduate students (...) tend to focus on clients’ symptoms, impairments, and functional problems, instead of integrating patients’ problems with their needs.”<sup>13</sup> We believe that providing undergraduate students with early experience<sup>30</sup> might provide an answer to the current lack of educational best practices.<sup>4</sup> Physiotherapy preclinical courses therefore should focus on best strategies to support the integration of theoretical knowledge and skills, thereby bridging the gap towards workplace-based learning of clinical reasoning skills<sup>13</sup>.

Whereas a clinical teacher can adapt the level of complexity to the individual student, preclinical physiotherapy education should focus more on the context of decision-making tasks<sup>11</sup> through case-based learning, incorporating integration of patients’ needs and experiences.<sup>13</sup> This could be done using a ‘whole-case’ format, presenting all case information at once, similar to the way patients present in real-life practice.<sup>31</sup> Students should be trained in taking a holistic approach to patient

problems, including the patient context instead of focusing solely on the biomedical part of the problem<sup>11,31</sup>.

To overcome possible barriers to learning, clinical teachers could be trained to provide individual feedback on students’ clinical reasoning and to support students’ critical reflection. On the other hand, the preclinical programme should aim to prepare undergraduate students for their clinical placements, in terms of expectations, development of working routine and potential issues in communication, such as language.

According to our findings, an open learning environment, active participation in a team of health care professionals and professional interaction between student and clinical teacher all support workplace-based learning, thus confirming the interdependence between teaching and student learning, sharing joint responsibility<sup>32</sup>.

#### 4.2. Implications for future research

This study shows the important influence of the professional rapport between student and clinical teacher on individual development in clinical reasoning.<sup>11,20</sup> It remains unclear in how far physiotherapy students copy or adapt to their clinical teacher's example of clinical reasoning or develop their own, rational, critical thinking. Further research into students’ development and assessment of clinical reasoning in the physiotherapy workplace is needed<sup>11,12,32</sup>.

#### 4.3. Limitations of this study

The participants in this study were self-selected volunteers. This may have inadvertently led to the inclusion of students and teachers who took a personal interest in clinical reasoning and to the exclusion of those with little interest in the subject. Although including physiotherapy students from diverse international backgrounds, these were following the same training programme according to the Dutch competence profile,<sup>5</sup> limiting generalisation of results.

## 5. Conclusion

Undergraduate physiotherapy students develop clinical reasoning skills during clinical placements whilst being increasingly exposed to a plethora of patient

categories, ranging from simple to more complex. Clinical teachers can support student learning by providing individual feedback and asking questions that induce students to reflect on their actions and learning. Students' learning is further enhanced by repetitive practice of physiotherapy skills, aimed at integrating elements of the clinical reasoning process into a more natural flow. Clinical teachers should stimulate their students to actively participate in practice, preferably within a team of different health care professionals and/or other interns.

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### Ethical approval

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### Other disclosures

Nil.

## Appendices

### A. Discussion guide for focus groups

1. How would you define 'clinical reasoning' in physiotherapy practice?
2. How did you learn (to apply) (the process of) clinical reasoning in practice?
3. What helps you to learn (to apply) clinical reasoning in practice?  
What hinders you in learning (to apply) clinical reasoning in practice?
4. How did your clinical teacher contribute to this learning process?
5. How did the preclinical ESP course on clinical reasoning prepare you to integrate clinical reasoning in physiotherapy practice?
6. Which strategies do you use to maximise learning of clinical reasoning skills?
7. When can you say you have 'mastered' clinical reasoning skills?

### B. Discussion guide for interviews

1. How would you define clinical reasoning in physiotherapy practice? (Unaltered)
2. What elements of clinical reasoning do you consider most important for learning clinical reasoning in practice? (Unaltered)
3. What facilitates students' learning of clinical reasoning in practice?  
What hinders students' learning of clinical reasoning in practice? (Adapted)
4. Which strategies do you use to maximize learning effect? (Adapted)
5. How did the previous knowledge on clinical reasoning help the ESP student to integrate clinical reasoning in physiotherapy practice?
6. When can one say he or she 'masters' clinical reasoning? (Adapted)

### C. Demographic details of participants.

Participant data	Students ( <i>n</i> = 22)				Clinical teachers
	Focus group A	Focus group B	Focus group C	Focus group D	Individual interviews
<b>No. of participants</b>	3	8	7	4	8
<b>Year of study</b>	2, 3	4	4	4	BSc. (3) MSc. (5)
<b>Average age</b> ( <i>Range in years</i> )	27 (23–31)	30 (22–37)	26 (22–30)	27 (21–33)	45 (29–64)
<b>Gender (F/M)</b>	1F/2M	2F/6M	2F/5M	3F/1M	1F/7M
<b>Dutch nationality</b>	1	1	1	1	7
<b>Clinical experience</b>	10 weeks ( <i>n</i> = 3)	30 weeks ( <i>n</i> = 7)	30 weeks ( <i>n</i> = 7)	30 weeks ( <i>n</i> = 4)	5–10 years (2) 10–15 years (2) 15–20 years (1) > 35 years (3)
<b>Average number of interns per year</b>		45 weeks ( <i>n</i> = 1)			2 (1–3)
<b>Dutch placements</b>	3 ( <i>n</i> = 3)	8 ( <i>n</i> = 17)	0 ( <i>n</i> = 14)	0 ( <i>n</i> = 8)	

### D. Templates for thematic analysis

Code	Theme	Code	Theme	Code	Theme
A	Definition of clinical reasoning in PT practice	1	Definition	A	Elements
		2	Mastery	B	Process
B	Learning clinical reasoning	1	Personal process	A	Elements
		2	Factors influencing learning	B	Strategies
				A	Clinical teacher
				B	Preclinical education
				C	Facilitating factors
					Limiting factors
SQ1	SQ2			SQ3	
Process	Learning environment				
Approach	Role of clinical teacher (communication)				
	Individual learning process (exposure/experience-based learning; facilitating and limiting factors; preclinical courses)			(elements of learning)	(strategies)

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