

PETRAHA+

EVALUATION OF CLINICAL REASONING IN PHYSIOTHERAPY



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1 INTRODUCTION

1.1 Foreword

The concept of “Evaluation” is defined as (Cambridge Dictionary, consulted in 2019):

- The process of judging or calculating the quality, importance, amount, or value of something, the judgement or decision made.
- The systematic collection of information about what the learner should know, be capable of doing, or aim for.

Clinical reasoning may be defined as:

“The thought and decision-making processes which enable the clinician to take the most appropriate actions in a specific, health-related, problem-solving context. It may be considered as the intellectual activity whereby the clinician summarises the information obtained in a clinical situation, incorporates it into their existing knowledge and experience, and uses it to take diagnostic and treatment decisions.”(Nendaz et al., 2005, p. 236)

This definition invokes two related concepts:

- Decision-making
- Clinical reasoning

These two concepts belong to different fields of research, the first focused on causes, where the clinician's reasoning is not optimal, such as cognitive biases, and the second on the way the clinician reasons in order to decide on actions to take.

Joy Higgs (2019, p. 408) emphasises “Although the two fields, of clinical reasoning and clinical decision-making, seem very different, the distinction is blurred when it comes to evaluation. We will therefore treat clinical decision-making as part of the clinical reasoning process...” [Back-translation]

Evaluation of clinical reasoning in physiotherapy tries to measure “a skill, process, or outcome wherein clinicians [and physiotherapists] observe, collect, and interpret data to diagnose and treat patients” (Daniel et al. 2019).

Because of the value of clinical reasoning in all the fields associated with the health sciences, researcher-clinicians have tried to develop methods, theories and algorithms associated with this concept, with the ultimate objective of finding the appropriate diagnosis for the patient's problem, as well as the most suitable treatment.

In physiotherapy, several steps are required in order to evaluate a particular case. For example:

- 1.- Questions about the patient's medical history.
- 2.- Results from the medical history
- 3.- Physical examination procedures.
- 4.- Results from the physical examination
- 5.- Choice of diagnostic test options.

- 6.- Results of diagnostic tests.
- 7.- Final diagnosis.
- 8.- Objectives / prognosis.
- 9.- Options for treatment / Applying therapeutic strategies.
- 10.- Evaluation of the impact of interventions and adjustments.
- 11.- Re-evaluation of the patient.

The literature has several different methods for evaluating clinical reasoning (Daniel et al. 2019):

1. Clinical/Comprehensive Integrative Puzzle
2. Concept Maps
3. Direct Observations
4. Extended Matching Questions
5. Key Feature Examination
6. Modified Essay Questions
7. Multiple Choice Questions
8. Script Concordance Test
9. Think Aloud
10. etc.

The list is not exhaustive, and includes more than 20 items.

Among these forms of evaluation:

- Some are quantitative, and try to assign an automatic score, such as: « Multiple Choice Questions, Script Concordance Test”,
- Others are qualitative, needing debriefing by a panel, such as: “Concept map or Think aloud”.

Charlin et al. (2003, p. 49) explain it as follows:

“Clinical reasoning is multi-dimensional. It covers, in particular, the ability to integrate data (the ability to gather data forms part of the evaluation of clinical skills, while collection strategies belong to the reasoning process); to generate hypotheses relevant to the clinical situation; to decide on the weight to give to each response as a function of each hypothesis; to decide on the correct diagnosis; to take appropriate decisions regarding investigation or diagnosis; etc. There is no instrument able to measure all these dimensions. Evaluation of each one of the dimensions of clinical reasoning therefore assumes the use of supplementary tools, each of which measures one or more of these dimensions.”

We therefore have to use various means of evaluation to understand the quality of the clinical reasoning of physiotherapy students.

In all cases, the reference point for these evaluations remains the expert panel. These experts will either form and weight these questions, or directly assess the reasoning expressed or represented by the student.

Encouraged by the maxim “Never the first time on the patient” (HAS, 2012, p. 11), which recommends the use of simulation as a student training tool, we have designed and create a serious game for training in clinical reasoning, but also for evaluating some of these processes.

Given the global conceptualisation, we chose to rely on recognised international references.

1.2 Clinical reasoning process according to the University of Montreal model

We first relied on the simplified clinical reasoning model from the University of Montreal (Audétat et al., 2016) (Figure 1). This has 5 main stages:

- Identify the indices at the very outset,
- Decide on the purpose of the meeting,
- Categorise in order to decide on the action (use review strategies when this is no possible),
- Implement the appropriate actions,
- Evaluate results.

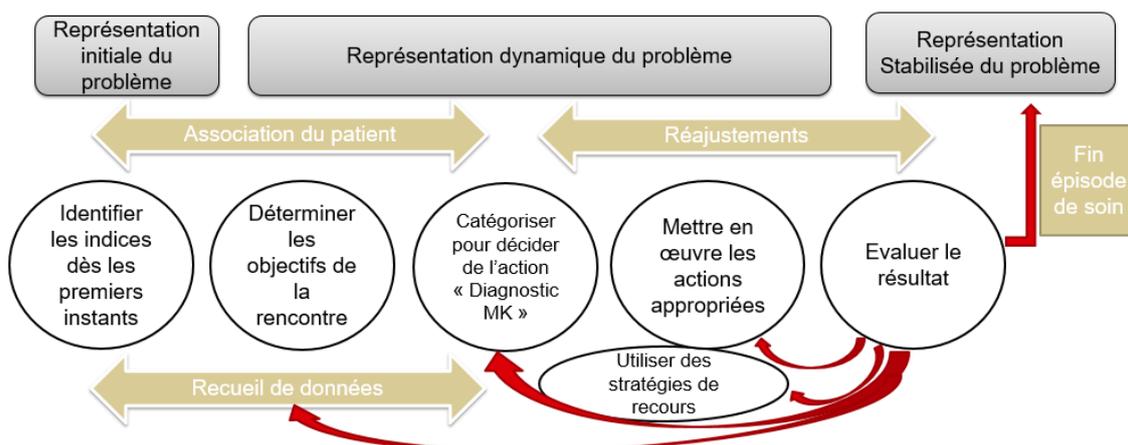


Figure 1: represents the simplified clinical reasoning model from the University of Montreal (adapted by the authors of the article)

This model is not specific to physiotherapy.

1.3 Physiotherapy diagnostics

The “Categorise to decide on the action” stage corresponds to the diagnosis stage in physiotherapy.

Among the definitions available for physiotherapy diagnosis, we have chosen that of World Physiotherapy (WCPT):

« Diagnosis in physiotherapy is the result of a process of clinical reasoning which results in the identification of existing or potential impairments, limitations in activities and restrictions in participation and of factors influencing functioning positively or negatively.

The purpose of the diagnosis is to guide physiotherapists in determining the prognosis and most appropriate intervention strategies for patients/clients and in sharing information with them. If the diagnostic process reveals findings that are not within the scope of the physiotherapist's knowledge, experience or expertise, the physiotherapist will refer the patient/client to another appropriate practitioner." (World Confederation for Physical Therapy, 2019)

1.4 International classification of functioning, disability and health

The WCPT's definition of physiotherapy diagnosis does imply categorisation, and relies on another international reference, an integral part of the training for physiotherapy students: "The international classification of functioning, disability and health" (ICF)(Edwards & Jones, 2007; Huber & Cieza, 2008; OMS, 2001)

We have relied on a representation of the CIF (figure 2) to show the first part of the clinical reasoning process by means of a concept map included in the serious game PETRHA+ (figure 3 and 4).

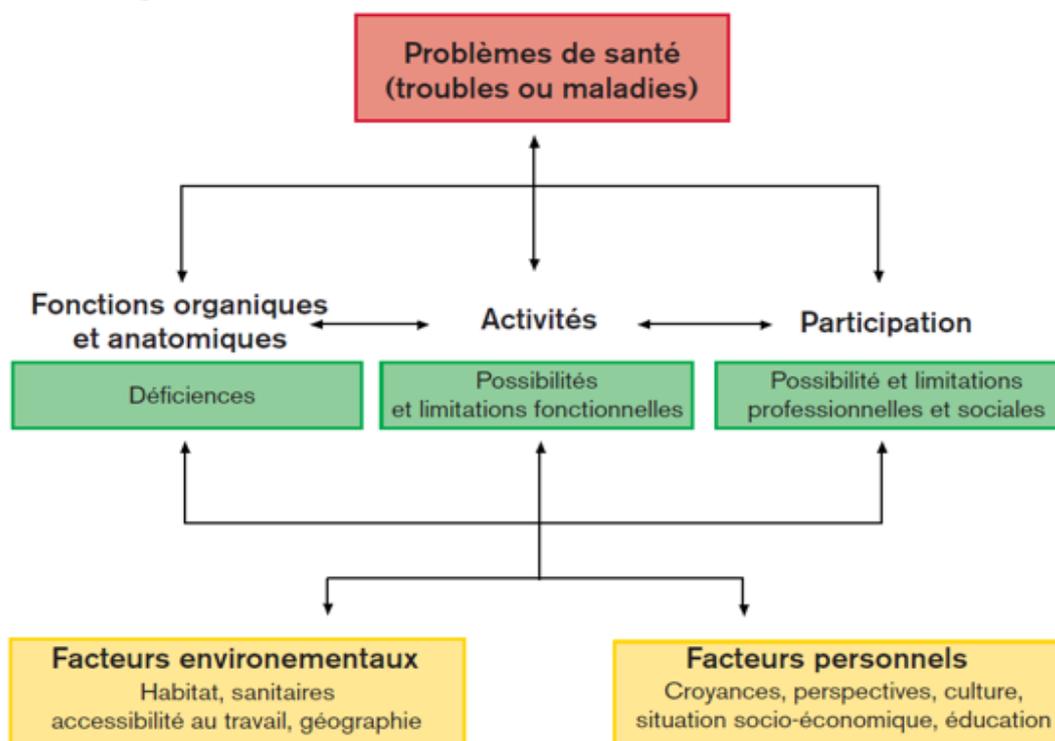


Figure 2: Health and disability model (Edwards & Jones, 2007)

1.5 Representation of diagnosis in physiotherapy as an explanatory support for clinical reasoning

We use the above model as a concept map to allow students to show their diagnosis and explain their reasoning. Personal and environmental factors were replaced by beneficial and disadvantageous factors, to take account of the definition of the "Diagnosis in physiotherapy" (World Confederation for Physical Therapy, 2019)

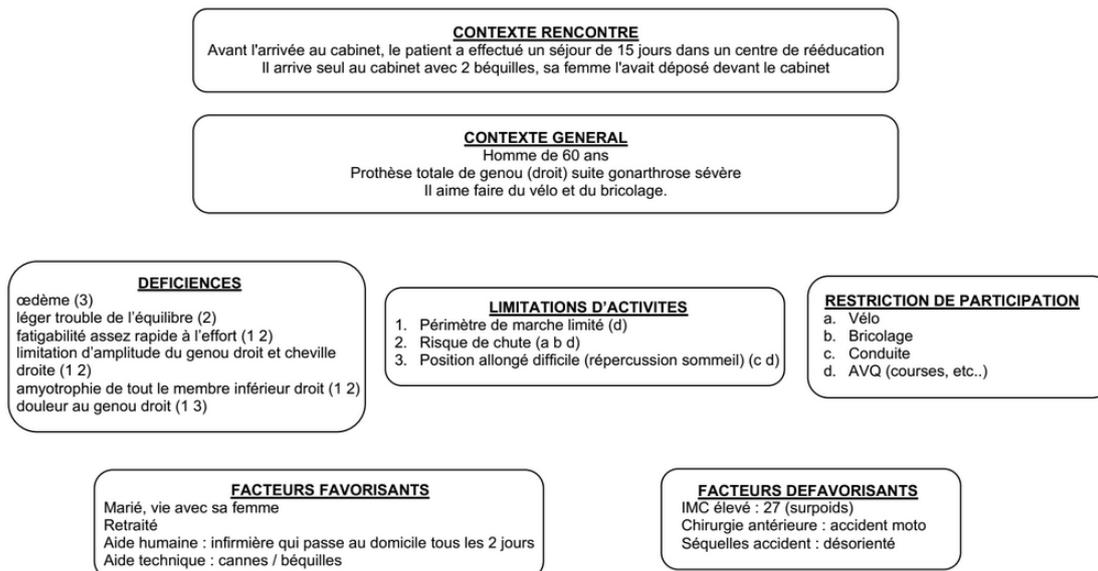


Figure 3: Illustrative example from a group of students of the reasoning used when carrying out a PETRHA+ case

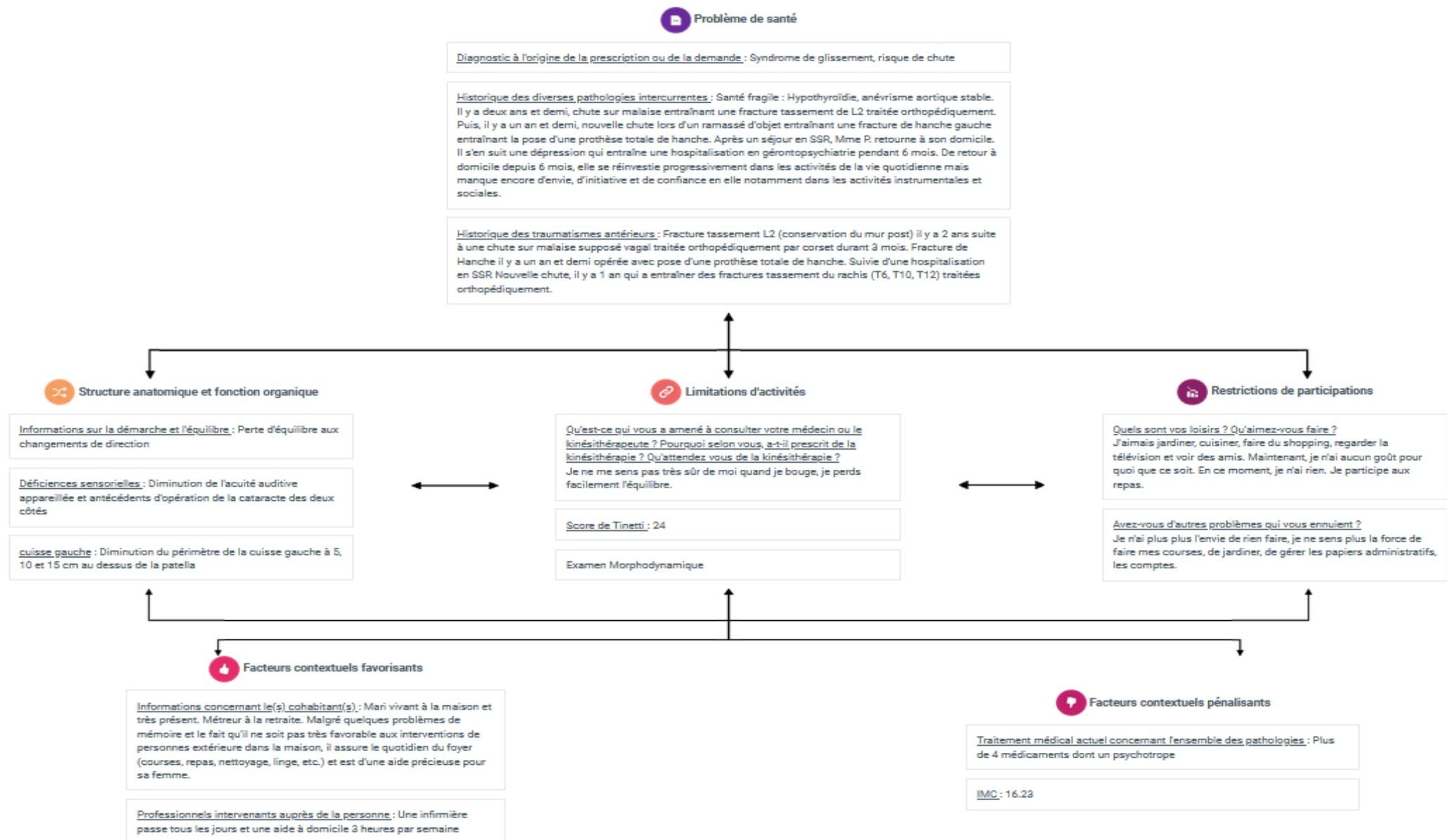


Figure 4: Screen capture of the concept map used in the serious game, and saved with the students' results.

2 Various methods for evaluating clinical reasoning developed in the PETRHA project

2.1 The PETRHA score

2.1.1 The quantitative part: the PETRHA score

In the serious game PETRHA, the student is invited to perform the various stages which reproduce the actions of the physiotherapist in care situations, and which reproduce the first 3 stages of the simplified Montreal model:

Stage 1: Data gathering

- Patient record
- Interview
- Clinical examination

Stage 2: Diagnosis (the number of items per category is a teaching choice to allow students to prioritise the main directions)

- 3 impairments and 3 limitations on activities
- 2 restrictions on participation
- 2 beneficial and 2 disadvantageous contextual factors

Stage 3: Determination of objectives

- 1 Final (Prognostic?)
- 2 intermediate
- 3 initial

These various stages lead to determination of a score, via the weighting of the various items (figure 5). Appendices 1 and 2 give the algorithms for calculating the diagnosis scores and the objectives.

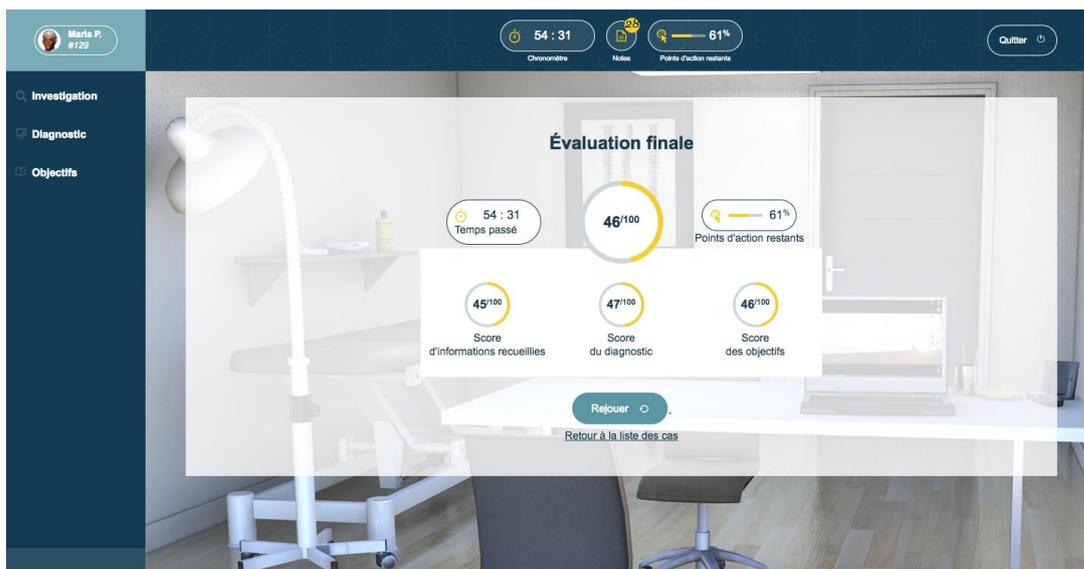


Figure 5: Representation of the score in the PETRHA+ serious game

This score identifies the quality of the data collection relating to the clinical situation, the quality of the diagnosis and the relevance of the objectives. Each element in the score is marked with a percentage of the maximum possible total. Finally, the total score refers to the average of the other three scores, weighted by the settings for the particular game session. According to the level of study, or the student's expertise, any one part of the score can be given precedence, to the detriment of the other parts. So for a first-year student, the data collection strategy may be prioritised. Conversely, at the end of the course, the emphasis will be placed on the diagnosis and objectives.

The time spent completing the clinical case is shown on the same page as the score.

Action points are calculated as a percentage of the number of items identified as relevant by the case study's creators.

With no further credits, the student can no longer collect information. This is done to encourage the student to identify the data relevant to the clinical case study being played.

However, finishing the game with a high action credit would mean that the student had completely missed all the information considered essential by the case study's creators.

2.1.2 Qualitative part of clinical reasoning evaluation, with PETRHA serious game

The last two stages of the simplified model are evaluated qualitatively.

The student must write down the objectives (work on formulating the objectives), and for each one:

- Identify the means to use in order to achieve the objective,
- Identify the evaluation tools chosen to ensure the objective is achieved.

2.2 Teaching recommendations for using the PETRHA serious game in evaluating clinical reasoning

Our various experiments have shown us that the student's involvement is much better when these case studies are played in pairs. The exchanges/discussions held with each decision-taking step form part of a socio-constructivist process which helps them to build their own reasoning, as well as formulate and explain it.

Before playing the game for the first time, students should receive an explanation of how it works, how scores are calculated and of the concepts underlying the idea of the serious game (Definition and model of clinical reasoning, CIF definition of diagnosis in physiotherapy) (Appendix 3).

A demonstration case must be played before an evaluation session (Appendix 3).

For working on a clinical case within a specialist area, on a specific pathology, the knowledge required must have been provided beforehand. All the authors agree that there can be no clinical reasoning without knowledge in the field being investigated (Higgs et al., 2019).

Finally, there must be a debrief on the clinical case, in order to explore all the reasoning involved with the students, including the qualitative part, and to optimise the effectiveness of the teaching experience (André & Galaup, 2020).

2.3 Use experience of the PETRHA serious game to serve clinical reasoning evaluation.

2.3.1 Organisation of gaming sessions/formative or summative evaluations

In the first year, or when introducing the game, it may be useful to create a small internal competition, to encourage involvement and motivation of the students. At the end of the session, students will be classified according to their score. A leaderboard could be organised.

During the game session, students create a concept map and state the objectives, therapeutic methods and evaluation tools considered.

The return from these elements may be the subject of a debrief (formative evaluation) or else of a presentation in front of a panel of experts for a summative evaluation (Appendix 3).

This process may be used in subsequent years of the course to evaluate clinical reasoning in each of the specialist fields.

2.3.2 Creation of clinical cases

Creation and design of cases by groups of students are especially formative.

The year group is divided into groups of three. Each group chooses a clinical situation, often inspired by a situation met during training (Appendix 3).

The concept map is used to represent the reasoning which the case supports. Each group plays a case created by another group, and offers a representation of the case played. The students are then assessed in groups of 6 (2 groups), by an expert panel.

Each group presents the reasoning processes worked out for their own case, and also for the one they played (created by the other group being assessed). So the comparison between the representations given by the groups leads to discussions and justifications, and ultimately adjustments to the clinical reasoning.

The panel assesses the quality of the clinical reasoning processes, the clinical cases thus created are further modified, and may be offered in gaming sessions to further student year groups.

2.3.3 The PETRHA Cups

Two PETRHA Cups were held in 2017 and 2021. These allowed meetings between students from various countries who had competed in various specialist fields:

Geriatrics in 2017, and 4 further specialist fields in 2021:

- Musculo-skeletal,
- Neurology,
- Cardio-respiratory,
- Paediatrics.

Every competition has a group phase, where teams of two students play two clinical cases within the chosen specialist field, then the four best teams in each specialism play a semi-final case, and the two best teams for each specialism then face each other in the final. The latest PETRHA Cup served to support research into clinical reasoning assessment, the preliminary results from which are presented in the next section.

2.3.4 Additional tools available for use

In their major work on clinical reasoning, Higgs et al. (2019) state that the advantage when evaluating complete clinical cases is that of placing the student in the situation, especially by means of the data collection, selection and summary strategy.

The drawback is the time needed for the task, which does not allow for several repetitions.

Unlike other methods, such as script concordances, the small clinical vignettes allow a large number of situations to be addressed.

These two processes seem to complement each other, and may be combined.

The first would require more reasoning as such, while in the second, the system would favour automation processes. This categorisation requires two different speeds of thinking, as described by Kahneman (2012) in his work "Système 1 / Système 2 : Les deux vitesses de la pensée" [System 1/System 2: The two rates of thinking"].

3 RESEARCH METHODOLOGY for validation of the PETRHA+ score as a tool for clinical reasoning

3.1 Evaluation tools and the PETRHA score

The clinical reasoning evaluation tool for PETRHA+ (**PETRHA SCORE**) consists of two elements:

- a) **1 Clinical case by specialism** (the case is used only for evaluation purposes):
The case is played on the PETRHA serious game platform.
 - Physiotherapy in paediatrics.
 - Cardiorespiratory physiotherapy.
 - Neurological physiotherapy.
 - Musculo-skeletal physiotherapy.
 - Duration: 30-45 min.
 - The teacher will have the information about the student's overall performance, and specific details for the various parts in resolving the clinical case:
 - *Research*: Patient data + Interview + Clinical examination.
 - Diagnosis.
 - Treatment objectives.
- b) **1 Validated questionnaire** (Bordage et al. 1990, 1991; Kicklighter et al. 2016) based on the clinical case completed:

Dr. Bordage et al. (1990) developed the “**Diagnostic Thinking Inventory (DTI)**”, to determine the cognitive process of an individual during clinical decision-making, for medical students in the various specialisms, and for experienced doctors. Initially it comprised 56 elements, reduced after revision to 41 elements. It uses a Likert-type scale, and each item is marked on a scale of 1 to 6, with one statement placed with the first number, and another at number 6. Depending on where on the scale the person completing the questionnaire is most in agreement with the statement, they will assign a number from 1 to 6 to the question. After carrying out a literature survey of the physiotherapy clinical reasoning evaluation tools, we will use the version of the DTI validated by Kicklighter et al. (2016) which is specifically adapted to physiotherapy. The PETRHA+ project team has permission from the authors (Dr. Bordage and Dr. Kicklighter) to use the DTI for the research.

- The questionnaire was created using a *Google Form* (https://docs.google.com/forms/d/1b16AVOhG-UGJezdRxtwla5Czvu44Y7fmJK_ZTZpjW5c/edit).
- 41 questions
- Duration: 15-20 min.
- All students are assessed with the questionnaire for the same clinical case in the same specialism. To do this, a clinical case from the PETRHA serious game is provided before the questionnaire to set the context, so that the

students can orientate themselves beforehand (Bordage et al. 1990; Kicklighter et al. 2016).

- The questionnaire provides information about the student's overall performance in two aspects of clinical reasoning:
 - *Memory structure*: Provides information about knowledge stored and organised (accumulated reflexive experience). Twenty questions are used to measure memory structure.
 - *Flexibility in organising thinking*: In relation to the ability to use several investigation and analysis methods among other diagnostic options. Twenty-one questions were designed to measure flexibility of thinking.

The average of these two elements forming the score (clinical case and questionnaire) will produce the **PETRHA SCORE** for clinical reasoning for this student, and in this particular specialism.

3.2 The objective of the PETRHA+ research

In order to ensure the viability and effectiveness of our clinical reasoning evaluation tool, we began by integrating a research project into the development of PETRHA+. This project was approved by the ethics committee of the Polytechnic University of Madrid (UPM), and its principal aim is to determine the effects of the PETRHA serious game on the clinical reasoning of European physiotherapy students.

3.3 Population, material and method

We chose the *PETRHA CUP II* (18-26 March 2021) to test our evaluation tool and begin to gather data on the clinical reasoning of European physiotherapy students. This widespread event included 66 students, more than 25 teachers, 5 countries and 19 Physiotherapy faculties. All the students were assessed for their clinical reasoning (Clinical case + Questionnaire), before and after the *PETRHA CUP II* competition.

3.4 PETRHA+ RESEARCH RESULTS

We are now busy analysing all the data, with a view to writing and publishing a scientific article. Nonetheless, we are able now to share some of these preliminary data relating to 10 of the students who took part (see *Table 1*, and *Figures 6-8*).

After using the PETRHA platform, we found significant improvements in the area of resolution of the clinical case, DIAGNOSIS ($p = 0.029$), and in the PETRHA SCORE ($p = 0.035$).

There is also an improvement in the rest of the variables for resolving the clinical case and in the questionnaire, but these are not significant.

Table 1. Results of 10 participants in *Questionnaire* and *Clinical Case*.

	PRE			POST			p
Assessment	77,20	±	9,81	81,10	±	9,23	0,179
Diagnosis	48,00	±	9,93	54,10	±	7,00	0,029
Goals	47,30	±	23,83	52,20	±	20,88	0,255
Global Score	56,80	±	10,22	62,00	±	7,79	0,070
Flexibility in thinking	81,80	±	14,30	85,00	±	16,96	0,062
Flexibility in thinking %	64,92	±	11,35	67,46	±	13,46	0,107
Structure of Memory	80,20	±	10,02	84,00	±	14,34	0,085
Structure of Memory	66,83	±	8,35	70,00	±	11,95	0,085
Total Score DTI	162,00	±	23,29	169,00	±	31,14	0,071
Total Score DTI %	65,85	±	9,47	68,70	±	12,66	0,071
Petraha Score	61,32	±	5,96	65,35	±	8,74	0,035

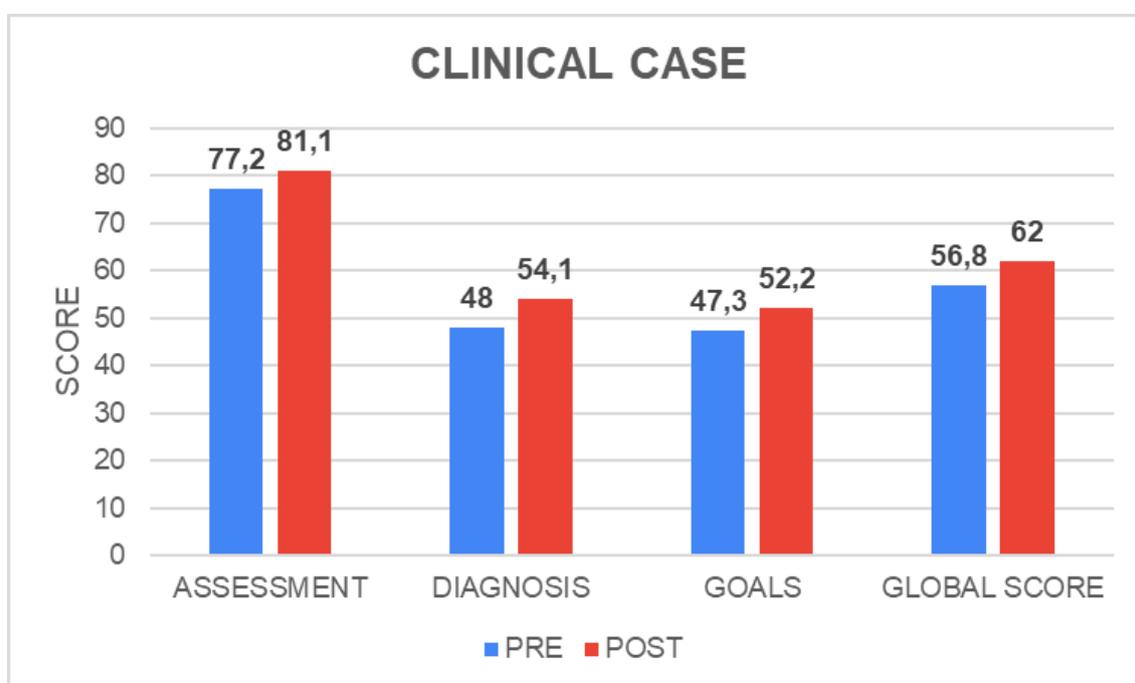


Figure 6: Clinical case

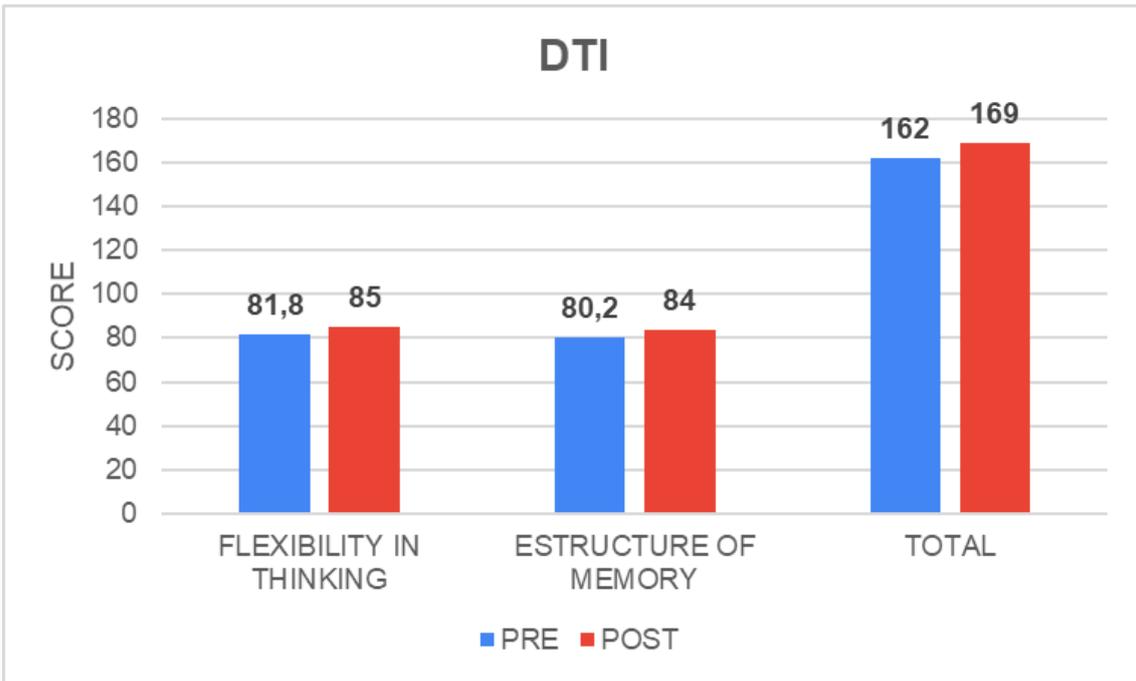


Figure 7: Questionnaire

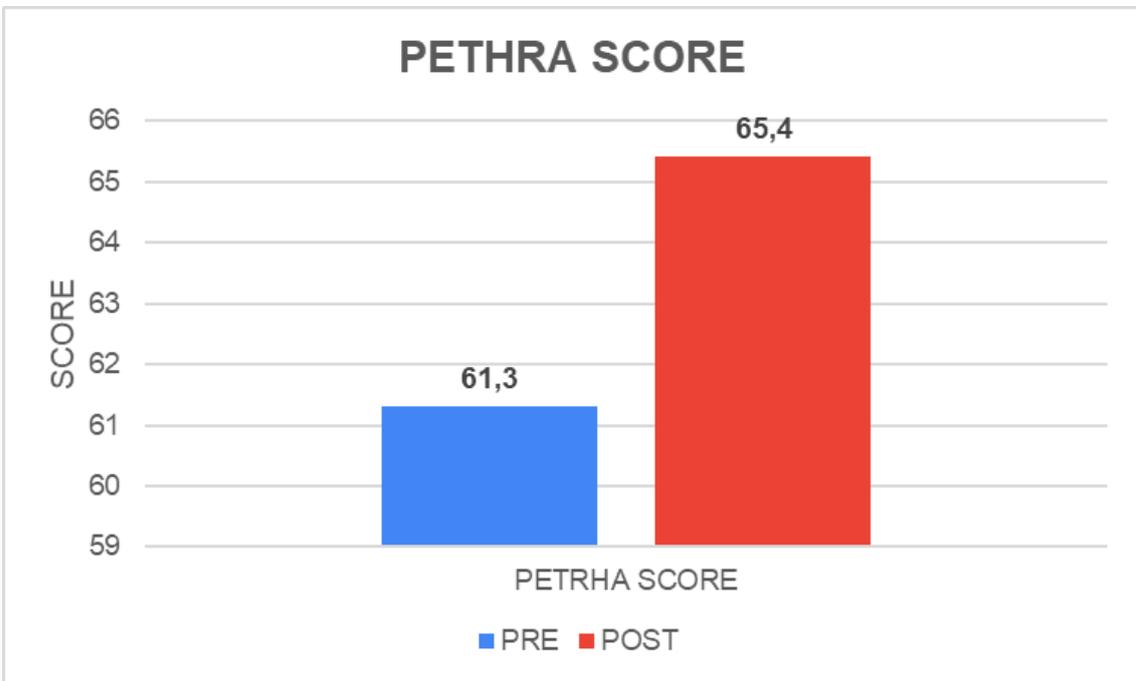


Figure 8: PETHRA score

3.5 DISCUSSION-CONCLUSION

The early results of the impact of the PETRHA platform on development of clinical reasoning among physiotherapy students are promising. Nonetheless, it is important to stress that the sample is small (n=10), and that the use of the serious game lasted only a short time (2 to 4 cases played).

The evaluation tool indicated for this PETRHA+ project is viable and effective in evaluating the clinical reasoning performance in each of the specialisms provided by PETRHA.

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APPENDICES

APPENDIX 1: DIAGNOSTIC SCORE CALCULATION ALGORITHM

	<u>Item order of importance</u>	<u>Multiplying Factor (Fixed)</u>	<u>Item's Pertinence (Configurable by Case creator)</u>	<u>Score</u>	<u>Score max (if there are enough items with pertinence 3)</u>	<u>Succes rate</u>
<u>General Context</u>	First	3	3	9	9	100,00%
	Second	2	1	2	6	33,33%
	Third	1	2	2	3	66,67%
<u>Impairments</u>	First	3	3	9	9	100,00%
	Second	2	1	2	6	33,33%
	Third	1	2	2	3	66,67%
<u>Activities limitation</u>	First	3	3	9	9	100,00%
	Second	2	1	2	6	33,33%
	Third	1	3	3	3	100,00%
<u>Participations Restriction</u>	First	3	2	6	9	66,67%
	Second	2	1	2	6	33,33%
<u>Positive Contextual Factor</u>	First	3	1	3	9	33,33%
	Second	2	1	2	6	33,33%
<u>Limitant Contextual Factor</u>	First	3	3	9	9	100,00%
	Second	2	1	2	6	33,33%
			Total	51	81	62,96%

APPENDIX 2: OBJECTIVES SCORE CALCULATION ALGORITHM

	<u>Action verb</u>	<u>Fonction</u>	Item of diagnostic	Multiplying Factor (Fixed)	Item's Pertinence (Configurable by Case creator)
End goal (1)	<u>Improve</u>	<u>Autonomy</u>	AIDL	3	2
Intermediate objectives (2)	<u>Increase</u>	<u>Speed</u>	<u>10 m walking test</u>	3	1
	<u>Improve</u>	<u>Balance</u>	<u>One leg standing</u>	2	2
Initial goals (3)	<u>Decrease</u>	<u>Pain</u>	<u>Analogic pain assesment at 7</u>	3	2
	<u>Increase</u>	<u>Strength</u>	<u>Testing at 2</u>	2	3
	<u>Increase</u>	<u>Articular Mobility</u>	<u>Hip Extension Range</u>	1	1

APPENDIX 3: TEACHING DOCUMENTS USEFUL FOR EVALUATING CLINICAL REASONING

PREREQUISITES FOR EVALUATION:

The link below, in the PETRHA section, will take you to:

- An example of the introductory course in French,
- An example of the concept map to offer to students,
- Links to the PETRHA as well as the recommended case for familiarisation with the game.

<http://lafermeafmk.fr/site/?Ressourcesdisponibles>

TEACHING MATERIAL: TWO EXAMPLES FOR EVALUATING CLINICAL REASONING AT THE END OF THE FIRST YEAR AND THE END OF THE SECOND YEAR OF STUDY

https://drive.google.com/drive/folders/12tEcY6gAhfc_zmKCzkRdMiHOr4Rb2jcB?usp=sharing



ERASMUS+ programme Strategic partnership

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