Detection of critical thinking skills in medical students using problem-based learning

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ABSTRACT
For medical professors, it is in their interest to encourage critical thinking (CP) in their students, however, factors such as understanding the meaning of the term, time and the amount of curricular content hinder this objective. Although various efforts have been made, it may be that the teacher is left with the uncertainty of the progress made by his students in this process that leads to medical reasoning, or it may be that he is satisfied with having encouraged this thinking without having an objective estimate that it has occurred. This research presents the didactic strategy of Problem-Based Learning (PBL) and a qualitative technique with which it was possible to carry out the observation record that allowed the identification of CP skills, according to Ennis' taxonomy, in a PBL session. It is possible to make use of the observation record during the PBL sessions, in order to, at first, note the actions of the students when addressing a PBL scenario during its resolution and then perform the categorization and numerical estimation with which it could be seen that the analysis of information is the category that was carried out with the highest frequency (28.7%). which was mostly made up of the ability to ask questions and answer clarifying questions. We consider, on the one hand, that the PBL strategy, in addition to allowing the teacher to comply in a timely manner with the revision of the thematic contents of the subject he teaches, will simultaneously promote the skills of the PC in his students, in addition, the teacher will behave as an observer who will be able to carry out the competence of teacher-researcher and will be able to verify the development of certain skills.

Keywords: PBL, Skills, Critical Thinking, Teacher-Researcher, Observation.

1 INTRODUCTION

Stimulating Critical Thinking (CP) as a generic and transversal competence is a task of enormous importance in different academic fields and in particular in the Health Sciences, specifically in the degree of Medical Surgeon, although the professors express their interest in promoting it in their students, it is convenient to locate the didactic strategies that can contribute from their teaching, to develop the PC in students.

In practice, teachers are faced with academic programs with abundant content, large groups of students, a considerable curricular load that affects the time available for teaching, in addition to the lack of developers of specific resources for teaching-learning; Therefore, it is necessary to strengthen the strategies already known and used in the teaching of Medicine, such as PBL, which, although from

its beginnings, allowed sequencing the steps to address situations that students will face in their future professional practice, it is now convenient to specify the competencies they develop.

CP is the cognitive process of thought in which rationality and reflection allow the subject to make decisions (López Aymes, G., 2012); In order to consider a person as critical, it is not enough to possess relevant skills, dispositions and knowledge, but it is necessary to put them into practice (López-Aymes, 2012 in Vendrell & Rodríguez, 2020). For educators in the 21st century, it is of great interest to promote CP, as the challenges of this millennium require creative and coordinated strategies to solve them.

In medical education, CP is of great importance, as future doctors will make decisions that will impact the quality of life of patients, for this reason the development of CP has been promoted in various educational centers. At the Faculty of Medicine of the National Autonomous University of Mexico, the CP is one of the competencies of the 2010 Plan of the Bachelor's Degree in Medical Surgery, which is why it is of interest to explore which activities favor the CP and record them, with the intention that medical area teachers can identify if the medical student uses the PC when carrying out the PBL strategy.

Although, during the teaching exercise, previous knowledge is applied and the logic of thought is activated, on which reasoning guided towards assertiveness in the diagnosis is based, it is essential to check it. To this end, three basic conditions of reasoning are required as a requirement to activate thinking: 1) having the knowledge, 2) applying it to similar situations or in new conditions of appearance, and 3) supporting it in the face of the situation that arises. To the extent that this process is optimized and improved, "the *conditions will be in place for the bases of reasoning to provide the experience towards the structuring of thinking that is increasingly conformed, more critical, more applicative and more accurate*; *Therefore, the levels of thinking will have to progress as the basis for reasoning improves."* (Asseburg Cruz O. R., 2016)

The structure of the CP has been a matter of interest for different authors, including as a precursor, Dewey, J. (1925) in Torres (2020), has underlined the importance of critique, stating that there are two dimensions that make up the CP: cognitive dimension and affective dimension that are expressed holistically.

On the other hand, Facione, P. A. (1989) reports that the experts who prepared the essay published in 1990, in the work Critical Thinking: A statement of expert consensus for purposes of educational assessment and instruction, in which they classified the cognitive abilities and attitudes, called "dispositions" towards the CP, placing in this last section, the inquisitive, open-minded, analytical, systematic, able to make judgments, seek truth, and rely on reasoning. Of the PC skills, consensus experts considered as essential: interpretation, analysis, evaluation, inference, explanation, and self-regulation.

Anastasiadou, S. D. & Aikaterini, D. (2011), point out that the need for critical thinking is important in education around the world (Hamers & Overtoom, 1999; Frangoudaki 2004, Ahmad Assaf, 2009). The CP movement was generated in the late 1970s and early 1980s (Lipman, 1991:101-113) in order to help students improve their reasoning about the problems encountered in everyday life. The focus is on learning, thinking, and instruction in subject areas (Hamers & Csapó, 1999), while metacognition and self-regulation appear to be key factors in the development of CP teaching (McGuinness & Nisbet, 1991; Efklides, 2006).

An important referent, as it returns to argumentation, is González, Z. J. H. (2006), who reports that Habermas (1999) emphasized the epistemological and ethical need for the general commitment of those who argue, to critically reflect on their personal and social beliefs and to adopt the different perspectives offered by others during argumentation, in addition to pointing out the usefulness of introducing, at this point Jürgen Habermas's ideas on human interests and domains of knowledge.

According to the consensus (Facione, P. A., 1989), critical thinking consists of an intellectual process that seeks to reach a reasonable judgment, in a decided, deliberate and self-regulated way, it is characterized because: 1) it is the product of an effort of interpretation, analysis, evaluation and inference of evidence and 2) it can be explained or justified, by evidentiary considerations. conceptual, contextual and criteria on which it is based.

Ennis, R. H. (1985), in his paper on "A Logical Basis for Measuring Critical Thinking Skills", defines it as reflective and reasonable thinking that focuses on deciding what to believe or do and establishes, which defined in this way involves both dispositions and abilities.

In the present study, it was proposed to assess the presence of CP skills in medical students during the resolution of a PBL exercise, in addition to testing an instrument with which it can be appreciated, considering the definition of what each of the skills represents, that is, To identify which of the actions performed by the students in a PBL session are characteristic of the CP and therefore it will be convenient to use this strategy and observation as a research technique to estimate the development of CP skills in the training of the general practitioner. PBL is a didactic strategy that is carried out under the methodological sequence of the following actions:

1a. Session

1. Presentation and review of a scenario (based on a real context)
2. Identification of clues, facts and/or guiding data
3. Problem Formulation
4. Hypothesis Setting
5. Definition of learning objectives
6. Searching for information

2a. Session

1. Presentation of the information consulted in accordance with the established objectives, in order to justify the confirmation, rejection or reformulation of problems

2. Presentation of the information consulted in accordance with the established objectives, in order to substantiate confirmation, discard or reformulate hypotheses

3. Introducing the Initial Scenario Add-on

PBL is student-centered, who is the one who determines what they need to learn, it is up to students to identify the key aspects of the problems they face, define their knowledge needs, and undertake the search for missing knowledge. (Morales, P., 2018).

There is a diversity of studies and instruments that seek to demonstrate how PBL is a strategy that can be used to promote and develop CP, such is the case of Morales (2018) who, through the application of the PENCRISTAL test, focused on highlighting the meeting points of the characteristics of the PBL methodology and the thought processes represented in the five factors or dimensions. namely: deductive, inductive, practical reasoning, decision-making, and problem-solving.

In the case of the study that is shared, the presence of CP skills was identified according to the taxonomy of Ennis, R. (2011), when carrying out a PBL session through observation and recording.

2 MATERIALS AND METHODS

In the context of medical education, an attempt is made to understand the reality in relation to the presence of the skills that make up the medical student's CP.

3 OBJECTIVE

Observe and record the actions performed by medical students in a PBL session and identify the PC skills detected by an observation recording instrument created *Ad doc.*

This is a mixed research, incorporating both qualitative and quantitative elements; It was based on a PBL session, in which the observed actions carried out by the students during the approach to a scenario were recorded. Then, the students' own PC skills were identified and it is framed both in the qualitative paradigm, which tries to understand reality and describe the facts in which the events take place, and in the quantitative paradigm, which records aspects of the phenomenon of interest, which can be quantified and measurable, from simple descriptions to complex causal relationships according to Aravena Marcela. Kimelman Eduardo, Micheli Beatriz, Torrealba Rodrigo and Zúñiga Javier (2006).

4 METHOD

Participants: The subjects observed in the first stage were medical students in the second year of the degree.

Technique: Systematized observation, it was chosen for its greater precision, which allows it to retain a certain flexibility and adapt to specific situations, as well as being the most usual, rigorous and of scientific interest (Garcia, S. J., Pacheco, S. D., Diez, G. M. García, M. E., 2010). This technique made it possible to restrict the observation to the approach of a PBL scenario in order to verify that the skills of the PC are used when performing them. It was useful because it is used in the study of small groups, as in the case of this study, in addition to quantifying the observation.

Instrument: The recording format corresponding to the diary or field notes was the instrument in which the observations were recorded. In a small group of three students, a clinical (written) scenario under the PBL strategy was reviewed. The record of notes was then placed in an assessment matrix, based on Ennis' taxonomy and after defining what each of the skills of the PC represents.

Strategy: based on a PBL scenario, students began to approach and follow the steps of the strategy in a session. With the students' consent, the skills used during the process were observed and recorded.

The selection of the operative definition of the categories used in the observation practice carried out and that corresponded to the 12 CP skills of Ennis' taxonomy was made, at this time, the categorical formats of other authors were used, in this case of the study "Manifestations of CP in the students of the Antonio Nariño University, Ibagué" (Arévalo, S. E., Guzmán, A. G. & Torres, M. G., 2007), which sought to recognize the PC skills required and possessed by students of Engineering, Dentistry and Psychology at the Antonio Nariño University, Ibagué campus, Colombia.

4.1 OPERATIONAL DEFINITION OF CATEGORIES USED

4.1.1 Analysis of information

Analysis is a complex skill; a definition of it is provided by Facione, who indicates that analysis comprises "identifying the effective inferential relationships between statements, questions, concepts, descriptions, or other forms of representation, for the purpose of establishing judgments, reasons, opinions, and sharing information" (Facione, 1994:4).

1. **Identify the central issue.** Focus on the central situation to be resolved, as a primary axis, through the formulation of questions or criteria that allow establishing possible answers to the situation under study.

2. **Analyze arguments.** Identify the conclusions; the reasons that allude to one cause or another of the situation under study; identify and manipulate irrelevance; see the structure of an argument;synthesize.

3. **Ask and answer clarifying questions.** Ask and answer questions that guide the analysis, such as why, what is the underlying argument, what do you mean by...?, what appropriate example could you give?, what would not be an example?, how does it apply to a case?, what difference does it make?, what are the facts?, what more could be said about it?

The purpose of making the necessary basic clarifications is to have a basis for proper interpretation, that is, to understand and express the meaning of a wide variety of experiences, situations, data, events, judgments, beliefs, rules, procedures, or criteria.

4.1.2 Inference

Inferring involves several cognitive processes, including deducing and evaluating deductions; This requires proficiency in class logic, conditional logic, interpretation of logical terminology in statements, including negations and double negatives, necessary and sufficient conditional language, using for example words such as "only" and "if and only if", "or", "something", "unless", "not both".

1. **Judge the credibility of the source.** Carry out through careful habits, the main criteria, such as expertise, agreement between sources, reputation, absence of conflict of interest, use of established procedures, ability to give reasons. **Observe and judge observation reports.** The main criteria are: minimal inference; short time interval between observation and report; report made by the observer and not by another; provide evidence; make competent use of the technology (if useful), and satisfy the criteria of credibility.

2. **Deduct and judge deductions.** Formulate or acknowledge valid conclusions that are inferred, established, or recognized from generalizations established in readings or discussions, and conclusions from particular data.

3. **Inducing and judging inductions.** Generalize the representativeness of the data (including sampling when necessary), substantiate the evidence, reach explanatory conclusions, including hypotheses; causal proposals, proposals about people's beliefs and attitudes, interpretation of the meaning that the author intends to establish, historical statement that certain things happened, informed definitions, argument that some proposition is an unstated reason, that the person used; Characteristic research activities (design of experiments and control of variables, search for evidence and counter-evidence, search for alternative explanations).

4.1.3 Arguments

Identify conclusions, stated reasons, explicit reasons, identify and handle the non-relevant, identify the structure of an argument, and summarize.

1. **Make value judgments.** Apply important factors such as: supporting facts, consequences of accepting or rejecting a judgment, evident application of acceptable principles, alternatives, balance, weighing, decision.

2. **Define terms and judge definitions.** Three dimensions of definitions: form, strategy, content. Useful forms are: synonymy, classification, rank, equivalent expressions, operational, examples, and counterexamples. Strategy: acts (reporting a meaning, stipulating a meaning, expressing a position), identifying and handling wrong. Use the content of the definition. Attributing unestablished assumptions (a skill that corresponds to both clarification and, to a certain extent, inference).

4.1.4 Decision-making

The process by which a choice is made between options or ways to resolve different situations in the disciplinary context. Decision-making basically consists of choosing an option from among those available, in order to solve a current or potential problem (even when there is no evidence of a latent conflict).

Decision-making at the individual level is characterized by a person making use of his or her reasoning and thinking to choose a solution to a problem that is presented to him; That is, if a person has a problem, they should be able to solve it individually by making decisions with that specific reason. In decision-making, the choice of a path to follow is important, so in an earlier state, alternatives for action must be evaluated. If the latter are not present, there will be no decision.

1. **Identify situations.** Detect cause and effect: Recognize when a situation occurs because of conditions, facts, and data previously presented within an argument or subject of study.

2. **Decide on an action.** Integrate other skills and dispositions to make and defend a decision. Follow the troubleshooting steps.

4.1.5 Interaction

Interaction between two or more objects, substances, persons, or agents.

1. **Interact with others.** Be sensitive to the feelings, level of knowledge, and degree of satisfaction of others. Employs appropriate rhetorical strategies in oral discussion and presentation.

Table 1 specifies the 12 skills that were identified in the process, and an abbreviation was assigned to their management.

Table 1. PC Skills

Ennis, R. Taxonomy for PC Skills (2002)	
1.Identify the central issue (**CC**)	2. Arguments of Analysis (**AA**)
3. Ask and answer clarification questions (**PP**)	4. Judging the Credibility of the Source (**JC**)
5. Observe and judge observation reports (**OIs**)	6. Deducting and Judging Deductions (**DJDs**)
7. Inducing and judging inductions (**I**)	8. Making Value Judgments (**HJV**)
9. Defines terms and judges definitions (**DT**)	10. Identify Situations (**SI**)
11. Decide on an action (**DA**)	12. Interact with Others (**IO**)

For the recording of the observation, three moments are presented, the first as Antecedent Behavior, the second as Central Behavior and finally the Consequent Behavior (*Table 2),* what it shows is the development of the events in which the process is described within the classroom. The recorded skills were assigned a numeral (from 1 to 75) with which they could be grouped by codes, which are associated with the same behavior, according to the action that each of the students performed.

Table 2. Record of observation during the approach of a PBL scenario. (Student 1, 2 and 3: A1, A2 and A3)

Type of Conduct	Action-Based Observation Units (CP Skill)
Central	1.A1, indicated that a student would begin with the reading of the case (DA)
Consequent	2.La teacher told her that she will make the session log (OI) herself
Central	3.A1, asked her other two classmates (Students 2 and 3), what they consider to be the relevant data of the case, she herself mentioned the fact that she is a 50-year-old woman, that she has not been menstrual for two years (0I)
Consequent	4. A2, noted vaginal dryness and burning (CC)
Consequent	5. A3, mentioned that a fortnight ago during his beach holiday he had sexual contact with a 60-year-old European tourist on two occasions, without protection (OI)
Antecedent	6. A2 commented that, although it may seem that what is relevant is the vaginal problem, the fact that the patient has a maternal aunt with breast cancer (SI) should also be considered
Central	7. A1 also pointed out that the Group and Rh O negative were sufficient food in quantity and quality (SI)
Consequent	8. A3, interpreted and commented that she is well nourished (DJD)
Central	9. A1 went on to mention negative smoking and occasional alcoholism (HJV) as relevant
Antecedent	10. A3 pointed out that the 5 heterosexual couples (HJV) were relevant
Antecedent	11. 1-minute pause, students silently reviewed the case (OI)
Central	12. A1 said that the number of pregnancies (3), caesarean sections (1) and deliveries (2), and the onset of sexual life at the age of 20 (OI) are also relevant
Antecedent	13. A1 and A2 reported the use of condoms as a method of family planning (SI)
Antecedent	14. A2, noted the presence of the negative Pap smear (OI)
Central	15. A1, continued the conduct of the activities and pointed out that the problems should be formulated now and said "we can put the discharge and vaginal problem are caused by sexually transmitted infection" (CC)
Consequent	16. A2 asked, how do we put it as a question? A1 pointed out the question: is vaginal discharge and problem caused by sexually transmitted infection? (IO)
Antecedent	17. A3, he mentioned, you have to check if they are bacteria or viruses (JC)
Consequent	18. A2, mentioned that they still didn't know if it was an infection (AA)
Central	19. A1 pointed out and re-asked the question: is vaginal discharge and problem caused by sexually transmitted infection? (PP)
Consequent	20. A2 and A3 took note (DA)
Antecedent	21. The three students, after taking notes, reviewed the A2 sheet again, pointed out that another problem is dryness and burning, which are due to menopause, and referred to the fact that it also does not "say" if it takes oral hormones (JC)
Consequent	22. A3 then asked, "How do you approach it?" (PP)
Central	23 A1, answered, are the dryness and burning due to the infectious process? (PP)
Consequent	24. A2, refuted, mentioning "the infection was before, it has to do with hormones (HJV).
Central	25. A1 and A3 indicated that they had to review menopause (AD)
Central	26. A1 mentioned that it would be the subject of study (DA)
Consequent	27. The three students noted that they had to carry out this revision (DA)

Antecedent	28. A2 pointed out that the question would be: what is the reason for dryness during intercourse? (PP)
Consequent	29. A3, mentioned "that's a hypothesis" (HJV)
Antecedent	30. A2 replied by clarifying that the hypothesis corresponds to the cause, to which the alteration is due, in addition to the fact that he was posing a question and that is how the problem is posed (HJV)
Consequent	31. A3, said to A2 how? (PP)
Antecedent	32. A2, again explained and replied "the problem is posed as a question and the hypothesis is the answer (PP)
Consequent	33. A3, went on to mention "yes, why is that, I got it" (AA)
Central	34. A1, then asked the question and pointed out, then it remains, "What is the cause of vaginal dryness and burning during intercourse?" (PP)
Consequent	35. The group took note (DA)
Central	36. A1 replied "because the pool has chlorine" (PP)
Consequent	37. A2 replied "no, it's due to an infection, because if we didn't every time we went on vacation and went to a pool, then we would be getting infected" (PP)
Antecedent	38. A3 noted, "yes, sure, the pH of the pool modifies the vaginal pH" (IS)
Consequent	39. A2, mentioned "swimming is not a cause of vaginal infection" (HJV)
Central	40. A1 commented "it is a vaginal infection, not a sexually transmitted one, that causes burning at intercourse" (HJV)
Consequent	41. A2, mentioned "the burning is because of menopause" (HJV)
Central	42. A1, replied "they don't even tell you if it's menopause" (JC)
Central	43. A1, he pointed out, "the hypothesis must be posed" (DA)
Antecedent	44. A2 asked, "Can swimming be a risk factor for vaginal infection?" and again asked, "Swimming is a risk factor for vaginal infection? (PP)
Central	45. A1, asked "is there no other problem anymore? (OI)
Consequent	46. A2, replied "I say no or we could say, if you perform breast self-examination, you have a risk factor for breast cancer and you cannot overlook the Pap smear" (IS)
Central	47. A1 then recommended that "the review of breast examination and exfoliative cytology should then be targeted", the group took note (DA)
Central	48. A1 hypothesized first: "If the patient had unprotected sexual contact, then she acquired a sexually transmitted infection" (I)
Consequent	49. A2, mentioned "depends on the characteristics of the flow" (CC)
Central	50. A1, nodded "yes."
Antecedent	51. A2, asked how do you tell when there is an infection?," (OI)
Central	52. A1, replied "pruritus" (DT)
Consequent	53. A2 asked, what is pruritus? (PP)
Central	54. A1, replied "itch" (DT)
Antecedent	55. A3, asked "Gonorrhea or vaginitis? (DT)
Antecedent	56. A3, noted "if you had unprotected sexual contact, then you may have acquired a sexually transmitted disease" and again asked "what is it called when you have pus?" (had no reply) (i)
Consequent	57. A2 mentioned, "the second hypothesis is, if this alteration, if these symptoms, burning and dryness are due to the state of menopause that alters the hormonal state" (I)
Antecedent	58. A3, I point out "it's not a hypothesis, I would put it, if- then, the hypothesis is a question" (AA)
Central	59. Student 1 intervened and proposed "these symptoms are due to the menopause in which the patient is, since it alters the hormonal state" (DJD)
Consequent	60. A3, noted "it's fine like this" (OI)
Central	61. A1 pointed out that "the third approach has to do with pH" (IS)
Consequent	62. A2, ask "if the pH is altered every time you go swimming?" (PP)
Antecedent	63. A3, mentions "at that age the defenses are low" (IS)
Antecedent	64. A2, formula "Yes, as pool water may cause a change in the patient's pH and allow the reproduction of an opportunistic agent" (IS)
Central	65. A1 mentions as an objective "How is the pH of the vagina modified?", and sets out the topics to be reviewed: menopause, causative agents of sexually transmitted infections, procedure for breast examination and exfoliative cytology, causes of pH modification in the body, breast cancer (AD)
Antecedent	66. The teacher intervenes and reinforces, pointing out to A3 that "the problem is posed as a question and the hypothesis is the explanation of the problem, mentioning that they may correspond to diagnostic hypotheses, formulated as differential diagnoses" (AA)

Antecedent	67.La professor mentions that both problems and hypotheses can be reformulated and/or supported after consulting information on the topics of study and asks A3 about the doubt she had about the infection (IO)
Antecedent	68. A3, asks what is vaginal discharge called when there is "infection" (PP)
Consequent	69. The teacher responds "leukorrhea" (PP)
Antecedent	70. The professor clarifies to Octavio that "the drop in immune defense does not depend on age" (DT)
Antecedent	71. The teacher instructs A1 and A2 to review the way in which the decrease in estrogen alters the vaginal flora and secretion and why the pH of the vagina is modified" (DA)
Antecedent	72. The teacher asks what sources they consulted (IO)
Consequent	73. Students answer bacteriology and propaedeutics (IO)
Consequent	74. The professor recommends that they also review in gynecology (IO) books
Antecedent.	75. The teacher indicated that the session had concluded and that she was waiting in the group's mail for the session log and the searches for information on the agreed topics (IO)

Table *3. Frequency with which CP* skills were put into practice when addressing a clinical situation under the PBL strategy, observation units were selected based on the specificity of the situation(s) that grouped CP skills, based on Ennis' taxonomy; the category name was assigned based on the common denominator of each code grouping.

Table 3. Frequency with which CP skills were put into practice when addressing a clinical situation under the PBL strategy

Observation units carried out in accordance with the action	PC Skills	Category
		Analysis of information
4, 15, 49	Focus on the Issue (**CC**)	3
18, 33, 58, 66	Analyze Arguments (**AA**)	4
19, 22, 23, 28, 31, 32, 34, 36, 37, 44, 53, 62, 68, 69	Ask and answer clarification questions (**PP**)	14
Total		**21 (28.7%)**
		Inference
21, 42	Judging the Credibility of the Source (**JC**)	2
5, 11, 12, 14, 17, 51,	Observe and judge observation reports (**OIs**)	6
8, 59	Deducting and Judging Deductions (**DJDs**)	2
48, 56, 57	Inducing and judging inductions (**I**)	3
Total		**13 (17.8%)**
		Argumentation
9, 10, 24, 29, 30, 39, 40, 41	Making Value Judgments (**HJV**)	8
52, 54, 55, 70	Defining Terms and Judging Definitions (**DT**)	4
Total		**12 (16.4%)**
		Decision-making
6, 7, 13,38, 46, 61, 63, 64	Identify Situations (**SI**)	8
1, 20, 25, 26, 27, 35, 43, 65, 71	Decide on an Action (**DA**)	9
Total		**17 (23.2%)**
		Interaction
2, 3, 16, 45, 50, 60, 67, 72, 74, 75	Interact with Others (**IO**)	10
Total		**10 (13.6%)**
Total Actions Performed Based on 12 PC Skills		**73**

5 RESULTS AND DISCUSSION

In a PBL session, 73 actions were identified corresponding to the 12 CP skills, the most frequent were: ability to ask and answer clarification questions (PP) on 14 occasions and was grouped in the category of information analysis accumulating 28.7% of the interventions and in second place the interaction with others (IO) which was carried out on 10 occasions and corresponds to 13.6% of the participations.

It is convenient to take up from Serrano (1993) the "need to reflect on the teaching-research problem, so that the practice of educating is incorporated into research, in order to bring research to teaching with the aim of modernizing or improving it, a concern of those educational sectors that have dedicated themselves to propagating the link between teaching and research".

This exercise demonstrates that it is possible to carry out an observation record of the dynamics within a class regardless of the strategy used, to reflect on its use and relevance, attending to a specific study program, which allows to assess and evaluate whether or not critical thinking (or any other competence) is developed and to identify the skills that predominate. with the possibility of keeping a documented record that allows educational research to be carried out on the activity of students within the classroom to objectively demonstrate and document the cognitive processes that are carried out.

6 FINAL THOUGHTS

The CP demonstrated by the medical students in this PBL exercise could be evidenced by addressing a classroom scenario, in which the essential medical reasoning process was carried out during their training, which will be required in the professional practice as well as the identification of problems that the PC must use.

PBL is a strategy that, associated with a registry, allows the detection of CP skills according to the indicated and detailed definitions, which are of great importance both for teachers and in the minds of professionals who formulate educational administration policies, since with them it will be possible to plan the place that CP will occupy in the training of students. as well as the way in which its teaching and assessment will be implemented.

The massification of education is a challenge for which a strategy of this type must be reflected, restructured and have the resources, in this case trained teachers with training in the field of educational research to be able to provide quality education that meets the condition of mass education.

REFERENCES

Anastasiadou, S. y Dimitriadou, A. (2011). What does Critical Thinking mean? A statistical data analysis of pre-service teachers' defining statements. International Journal of Humanities and Social Science Vol. 1 No. 7. 73-83. https://www.academia.edu/12872501/What_does_Critical_Thinking_mean_A_statistical_data_analysis_of_pre_service_teachers_defining_statements

Aravena, M., Kimelman, E., Micheli, B, Torrealba, R. y Zúñiga, J. (2006). Enfoque Metodológico Cualitativo. En Investigación educativa I. (39-97). Convenio interinstitucional. Chile. Recuperado de: http://jrvargas.files.wordpress.com/2009/11/investigacion-educativa.pdf

Arévalo, E., Guzmán, G. y Torres, G. (2007). Manifestaciones individuales de pensamiento crítico en los estudiantes de la Universidad Antonio Nariño, Ibagué. Trabajo de grado. Manizales. https://repository.cinde.org.co/bitstream/handle/20.500.11907/373/ArevaloSierraEdelmira2007preliminar.pdf?sequence=2&isAllowed=y

Asseburg Cruz O. A. (2016). Comunicación verbal de especialista en Educación Médica. Asesoría de Posgrado.

Blanchet, A., Ghiglione, R. Massonnate, K., Trognon, A.(1989). Técnicas de investigación en ciencias sociales: datos, observación, entrevista, cuestionario. MadridChávez de la Rosa, Daniel, Tass Rosado, Jocelyn Dayani, Villarreal Del Valle, Lineth Iluvinda, Sandoval Bernal, Sergio Danset, & González

Csapó y Hamers. (1999). Improving thinking through the content of teaching. In: J. Hrs, J. E. . M. Hamers H. van Luit & B. Csapó (Eds.), Teaching and learning thinking skills (pp. 37-62). Lisse: Swets and Zeitlinger. https://core.ac.uk/download/pdf/93015312.pdf

Ennis, R.H. (1985). A logical basic for measuring critical thinking skills. *Educational Leadership*, 43 (2), 44-48. Recuperado de http://www.ascd.org/ASCD/pdf/journals/ed_lead/el_198510_ennis.pdf

Ennis, Robert H. (2011). Goals for a critical thinking curriculum and its assessment. https://education.illinois.edu/docs/default-source/faculty-documents/robert-ennis/thenatureofcriticalthinking_51711_000.pdf

Facione, Peter (1989), "Critical thinking: a statement of expert consensus for purposes of educational assessment and instruction", en American Philosophical Association, California, The California Academic Press, pp. 1-111. https://www.researchgate.net/publication/242279575_Critical_Thinking_A_Statement_of_Expert_Consensus_for_Purposes_of_Educational_Assessment_and_Instruction

Facione, N. C., Facione, P. A., Sánchez, C. A. (1994). *Critical thinking disposition as a measure of competent clinical judgment: the development of the California critical thinking disposition inventory*. Journal Nurs Education. Oct. 33(8): 345-50 Recuperado de http://www.ncbi.nlm.nih.gov/pubmed/7799093

Facione, P. A. (2015). "Critical thinking: what it is and why it counts?". Millbrae, CA: California Academic Press. https://www.insightassessment.com/wp-content/uploads/ia/pdf/whatwhy.pdf

Garcia, S. J., Pacheco, S. D., Diez, G. M. García, M. E. (2010). La metodología observacional como desarrollo de competencias en el aprendizaje. International Journal of Developmental and Educational Psychology. Nº3,2010. pp:211-218 https://www.redalyc.org/pdf/3498/349832326022.pdf

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González, Z. J. H. (2006*).* Evolución del pensamiento crítico en la educación superior. Discernimiento Cali, Colombia: Universidad Icesi. Recuperado de http://www.eduteka.org/pdfdir/DiscernimientoHipolitoIcesiCompleto.pdf

Hamers, J. H. M. & Overtoom, M. Th. (1999). Teaching thinking: Programmes and evaluation. Psychology, 6 (3), 265-277. https://publicatio.bibl.u-szeged.hu/6083/1/1999_Hamers_Csapo.pdf

Lipman, M. (1991). Thinking in Education. Cambridge: Cambridge University Press. https://www.researchgate.net/publication/315872490_Lipman's_Thinking_in_Education

López Aymes, G. (2012). Pensamiento crítico en el aula. Disponible en: https://www.educacion.to.uclm.es/pdf/revistaDI/3_22_2012.pdf

McGuinness, C. & Nisbet, J. (1991). "Teaching Thinking in Europe". British Journal of Educational Psychology, 61, 174-186.

Mejía, Verenice Zarahí. (2020). Simulación clínica y dimensiones de pensamiento crítico en estudiantes de medicina de una universidad privada. Investigación en educación médica, 9(36), 70-77. Epub 09 de diciembre de 2020. Disponible en: https://www.scielo.org.mx/pdf/iem/v9n36/2007-5057-iem-9-36-70.pdf

Morales Bueno, P. (2018). Aprendizaje basado en problemas (ABP) y habilidades de pensamiento crítico ¿una relación vinculante? Revista Electrónica Interuniversitaria de Formación del Profesorado, 21(2), 91---108. https://revistas.um.es/reifop/article/view/323371

Núñez-López, Susana, Ávila-Palet, José-Enrique, & Olivares-Olivares, Silvia-Lizett. (2017). El desarrollo del pensamiento crítico en estudiantes universitarios por medio del Aprendizaje Basado en Problemas. Revista iberoamericana de educación superior, 8(23), 84-103. Recuperado de http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S2007-28722017000300084&lng=es&tlng=es

Serrano Castañeda, J. A., & Pasillas Valdez, M. Á. (1993). Tradiciones en la investigación sobre la educación.. Perfiles Educativos, (61). Recuperado de: https://www.redalyc.org/articulo.oa?id=13206101

Torres, H. (2020). Tres dimensiones del proceso reflexivo: modelo psicológico. Revista Electrónica de Psicología Iztacala. 23, (1), 200-229. https://www.revistas.unam.mx/index.php/repi/article/view/75388

Vendrell I Morancho, Mireia, & Rodríguez Mantilla, Jesús Miguel. (2020). Pensamiento Crítico: conceptualización y relevancia en el seno de la educación superior. Revista de la educación superior, 49(194), 9-25.https://www.scielo.org.mx/pdf/resu/v49n194/0185-2760-resu-49-194-9.pdf