

Teaching Clinical Reasoning and Critical Thinking in Psychology Graduate Courses: A Systematic Review

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Abstract

Introduction: There are many studies and reviews that investigate the most functional ways of explicitly teaching clinical reasoning skills in more traditionally healthcare areas such as medicine and nursing, hypothesizing that reducing the gap between theory and practice could guarantee continuity in the quality of care provided to patients.

Clinical reasoning and critical thinking are aspects that in clinical practice guide the psychologist in diagnosis and intervention. However, in the psychological field there is a lack of experimental studies that address the issue of direct or explicit teaching of these skills.

This systematic review study sought to investigate, via a systematic review, whether there is an association between the teaching methodology and the student's improvement in their critical analyses and clinical reasoning skills.

Statement of the Problem: Despite the importance for clinicians, the interest of researchers and academics is quite recent. Teaching of clinical reasoning is, on the contrary, more common in medicine and nursing sectors.

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Methodology: Articles published from 2004 until 2023 within PubMed (National Center for Biotechnology Information, NCBI), Web of Science (Core Collection, Clarivate Analytics), Scopus (Elsevier), EBSCO, Scielo, and Psycinfo databases were searched through the following keywords: Critical Thinking - Clinical Reasoning; Problem Based Learning - Case Based Learning; Teaching Methods - Teaching Strategies; Learning Strategies - Clinical Learning; University; Intervention - Training; Psychology; Psychology Students.

Results: Theoretical and practical implications to teach clinical reasoning and critical thinking in the psychological field were discussed, including recommendations for designing researches aimed at investigating the impact of the different methodologies, as well as the possibility of including education in critical thinking within the different levels of training dedicated to psychologists.

Conclusion: The collected studies presented methodologies that, although different, significantly promoted the improvement of critical thinking in university students, demonstrating that it is “possible” to transfer this complex skill.

Keywords: clinical reasoning, critical thinking, clinical learning, psychology students, teaching methods

Clinical Reasoning and Critical Thinking in the Health Professions

The following review originates from the authors’ interest to investigate the theme of teaching clinical reasoning and critical thinking in Psychology graduate courses. As a matter of fact, a great deal of the psychological know-how consists of immaterial aspects, such as clinical reasoning, critical thinking and judgement, problem solving which in the clinical practice, guide the psychologist in the choices of diagnostic and intervention (Norman, 2000). Despite the importance of such constructs in infrastructures and for clinicians who work in the territory, the interest of researchers and academics is quite recent (Andrews & Syeda, 2016). Teaching of clinical reasoning and other non-conceptual skills is, on the contrary, more common in areas traditionally dedicated to healthcare, such as the medicine and nursing sectors (Burbach et al., 2015; Norman et al., 2018; Pelaccia et al., 2020).

There is a large number of studies and reviews addressing the most functional methods of explicit teaching of clinical reasoning skills in the healthcare sector (Abrami et al., 2008; Delany et al., 2020; Mason et al., 2020; Pramila-Savukoski et al., 2019; Richmond et al., 2020). These

studies have substantially increased in the last few years, also due to the pressure exerted by the emerging needs of healthcare infrastructures: employee turnover, massive retirement and lack of formal tools of transition to the labour market impose that, after completion of studies, the practitioner should be able to not only do, but also “think” of what to do (Cavallini et al., 2019; Torre et al., 2020). This systematic review/survey is inspired by the work of Payan-Carreira et al. (2019), a systematic literature review which presents and discusses teaching methodologies and assessment tools for clinical reasoning and critical thinking in healthcare.

The objective is to develop a first formal and systematic reflection on the educational practices of clinical reasoning and critical thinking in psychology. Critical thinking will be defined as the skill set that lead to a process of reflection which translates into interpretation, analysis and evaluation of data (for instance, diagnostic and criterial tests) in order to reach a judgement (Payan-Carreira et al., 2019; Sternberg & Halpern, 2020).

In literature the terms clinical reasoning, clinical judgement, problem solving, decision-making process and critical thinking are often used interchangeably (Faucher, 2011; Payan-Carreira et al., 2019; Shin, 2019). They are defined as the mindset that clinicians get into when thinking about the issues they face in their practice. It deals with clinical judgements (making a decision regarding what is right and what is wrong) and clinical decision-making process (deciding what to do), (Guerrero, 2019; Payan-Carreira et al., 2019; Royce et al., 2019). To summarize, clinical reasoning and critical thinking emphasize slightly different aspects but are often considered synonyms; research and reviews author, however, are aware of the differences between the two constructs, at theoretical level as well as in the ways of measurement and evaluation (Faucher, 2011; Payan-Carreira et al., 2019). In order to clarify this topic, Joyce (2013) developed a systematic review focused especially on the different ways in which various authors define the processes of critical thinking and clinical reasoning, focusing on the specificities of each construct and presenting the reader with the diverse intervention and assessment tools.

Although it presents differences and specificities, the review highlights how in synthesis tasks it is possible to use the terms interchangeably. As it is the case of this survey itself, they have been used indistinguishably in research with the scope of including as many relevant publications as possible.

Clinical Reasoning is conceptualized as that process through which healthcare professionals generate clinical judgement by choosing from

the alternatives, weighing the evidence, using intuition and recognizing reference models. It is a logical process through which healthcare specialists gather clues, elaborate information, come to an understanding of a problem affecting a patient or a situation, plan and carry out interventions, assess the results and reflect and learn the process (Faucher, 2011; Koufidis et al., 2020; Payan-Carreira et al., 2019; Robertson, 2012). Thus, clinical reasoning results in an intellectual activity which belongs to any profession and that, starting from a variety of information, leads to the identification of problems that are objects of interest (Kosior et al., 2019; Young, Thomas, Gordon et al., 2019). It is a form of circumstantial thought where clues are observable elements that stimulate to further research for new information and is based on the hypothetical-deductive process through the generation of one or more hypotheses (Al Rumayyan et al., 2018; Huhn et al., 2019). In the field of psychology this process starting from a health issue, an attitude, behavior or thought, passing through the medical condition, anamnesis and individual history leads to the formulation of one or more diagnostic hypotheses.

Critical thinking and clinical reasoning have in common a number of factors: the intentional commitment to ask clear and well-formulated questions, the gathering and assessment of relevant information, the care in thinking of available alternatives, the ability to recognize and assess hypotheses by taking into account the implications and practical consequences, hence the communication with other professionals (Payan-Carreira et al., 2019; Rutter & Harrison, 2020).

In the last decades the acquisition of clinical reasoning and critical thinking competencies (particularly for doctors, dentists, nurses, neuro psychomotricists and speech therapists) is once again of interest to higher education institutions (Choi et al., 2020; Ihm et al., 2020; Mutter et al., 2020; Pierce et al., 2020; Robertson, 2012). This interest and studies are aimed at the analysis of teaching practices which can transfer useful skills to facilitate the transition of recent graduates to the labour market (Vidyarathi et al., 2016; Young, Thomas, Lubarsky et al., 2020).

In the healthcare sector reducing the gap between theory and practice could favor recent graduate's integration in the work-team and guarantee the continuity of quality of care provided to patients (Durning et al., 2019). While these considerations are valid for the medical field (doctors and nurses) and in all historically health professions (speech therapists, occupational therapists, physiotherapists), specifically in the psychological field we witness the great shortage of experimental studies tackling the theme of direct or explicit teaching of the abilities described.

Data concerning the increase of mental health issues related to the Covid 19 pandemic (Li et al., 2020) suggest that the request of psychologists on the territory will undergo an increase; therefore, it becomes relevant to explore the teaching practices and methodologies that promote the acquisition of fundamental skills in the clinical practice. This systematic revision intends to evaluate the status of current teaching practices in use and tested to promote the acquisition or the improvement of critical thinking and clinical reasoning in psychologists or psychologists in training.

Method

In order to assess the current state of research within the area of teaching and education with regards to clinical reasoning and critical thinking in the psychological sector, we have worked on a systematic review of the literature in Italian and English languages published from 2004 until 2023.

The research has been carried out within five online databases: PubMed (National Center for Biotechnology Information, NCBI), Web of Science (Core Collection, Clarivate Analytics), Scopus (Elsevier), EBSCO, Scielo (Scientific Electronic Library Online) and Psycinfo.

The following Boolean search phrases combination was used: (Critical Thinking “OR” Clinical Reasoning) AND (University “OR” Intervention “OR” Training) AND (Psychology); (Problem Based Learning “OR” Case Based Learning) AND (Critical thinking “OR” Clinical Reasoning) AND (Teaching Methods “OR” Teaching Strategies) AND (Psychology Students); (Critical Thinking “OR” Clinical Reasoning) AND (Learning Strategies “OR” Clinical Learning) AND (Psychology Students).

Inclusion criteria applied in this review were outlined before searching for literature, and developed by means of PICOS (Methley et al., 2014):

- P (Population) – Students enrolled in Graduate courses (Bachelor or specialized training), Master or PhD in psychology or Postgraduate traineeship;
- I (Intervention) – Educational strategies explicitly used to teach clinical reasoning and critical thinking;
- C (Comparison) – Assessment tools and educational strategies;
- O (Outcomes) – The effective development of skills based on different educational strategies and assessment tools;
- S (Study Design) – Any quantitative study.

Every article has been jointly analysed by two reviewers. A first analysis was performed on 91 research articles published between 2004 and 2023. Fifty-three studies were excluded from the analysis as books, book chapters, dissertations, reviews, non-empirical studies, articles that did not investigate psychology students but those of medicine and nursing (or other professions) and which did not examine students but professionals.

In the second analysis, 35 articles were screened, of which 25 excluded for skills and dispositions not evaluated (clinical reasoning and critical thinking), subject and field of study not relevant to the analysis conducted.

Nine articles were evaluated for eligibility and included in the quantitative summary (Figure 1).

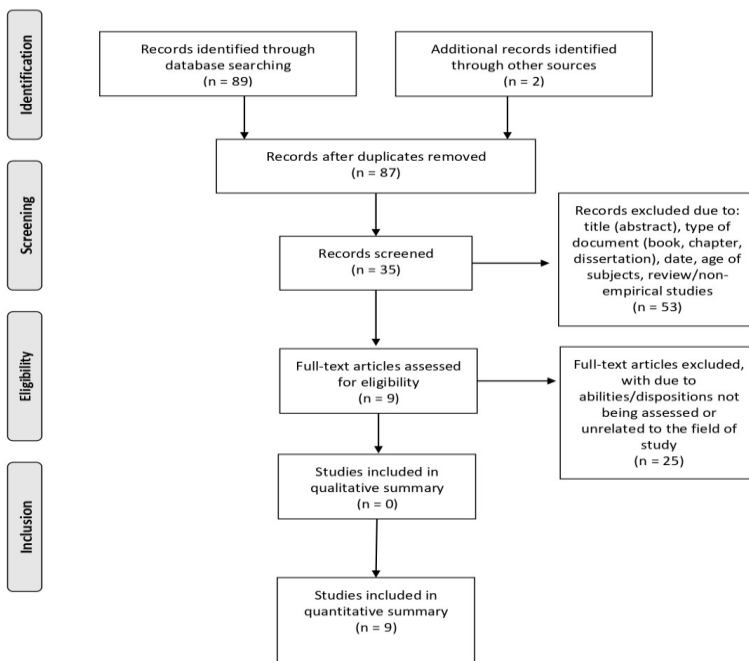


Fig. 1 - Systematic review steps flowchart

The extracted articles have been analysed by using a supplementary table (Table 1), created to recover relevant data.^[1]_{SEP}

Tab. 1 - *Supplementary table created to recover relevant data*

Authors	Participants	Assessment	Intervention	Results
Penningroth, S.L., Despain, L.H., & Gray, M.J. (2007)	47 students from the Psychological Sciences (PS) course group and 119 students from the comparison group enrolled in a General Psychology (GP) course	Psychological Critical Thinking Exam (PCTE), (Lawson, 1999)	Small team activities and group discussions, frequent close-ended questions and a final written task which required comparing the scientific research results to the evidence	Results show an increase in critical thinking skills
Solon, T. (2007)	51 Psychology students	Cornell (Z) Critical Thinking Test (Ennis et al., 1985) Textbooks and study guides exercises The 5 methods of Mill Socratic interrogation technique to stimulate critical thinking	The experimental group undergoes general critical thinking learning through a class laboratory and homework	The study demonstrates a significant and substantial growth of the students' critical thinking skills
Bensley, D.A., Crowe, D.S., Bernhardt, P., Buckner, C., Allman, A.L. (2010)	47 psychology students	Three Critical Thinking (CT) psychological test subscales (Bensley & Baxter, 2006) Version of 20 items of the reduced form of the Need for Cognition Scale (Cacioppo & Petty, 1982) Checklist for educational background assessment GPA to assess academic results SAT scores to assess academic skills	Students from the SRM class have analysed a literature review, completed homework and took quizzes on these abilities, and hence received corrective feedback about all their work. Students from traditional & RM lectures have received instructions focused on learning statistics, design and research methodology, and on how to write a research report in the style of the American Psychological Association (APA)	Results support the efficacy of explicit teaching of critical thinking skills infused directly into normal course lectures
Haw, J. (2011)	84 second year students and 60 fourth year Psychology students	Psychological Critical Thinking Exam (PCTE), (Lawson, 1999)	Education-based teaching practice designed to improve psychological critical thinking skills	Results show a significant increase of critical thinking abilities and confirm the value of the education-based teaching practice

Karantzas, G.C., Avery, R.M., Macfarlane, S., Mussap, A., Tooley, G., Hazelwood, Z., & Fitness, J. (2013)	273 third year psychology students	Self-efficacy Learning scale (Zimmerman, Kitsantas, & Campillo, 2005) Academic Motivation scale (AMS-C 28, Vallerand et al., 1992) Study process revised questionnaire (R-SPQ-2F, Biggs et al., 2001) Measure consisting of seven items specifically developed to study critical analysis and problem-solving skills	Collaborative learning approach (CLA) and use of a tutorial program created to encourage the development of university students' critical analyses and problem-solving skills. The program is inspired by the "Choose Your Own Adventure" (CYAO) series of novels	Students showed an improvement in their critical analyses and problem solving
Muehlenkamp, J.J., Weiss, N., & Hansen, M. (2015)	74 Psychology students enrolled in a Psychology introductory course	Five self-report questions from the interview Cognitive Subscale of the Student Engagement (Ahlfeldt et al., 2005) Five scenarios adapted from "Lawson's (1999) psychological critical thinking" Items from the Student Course Engagement Questionnaire (SCEQ), (Handelsman et al., 2005)	One of the authors, after examining various resources of PBL (es. Duch et al., 2001), has structured the 16 weeks Psychology course introduction into 4 learning units based on problems, and one learning unit generated by the students	Results show a significant increase of critical thinking skills, psychological research analysis abilities, and emotional involvement
Wentworth, D.K., Whitmarsh, L. (2017)	275 Psychology students, 89 of which have completed all three assessments	Questionnaire (of 13 items) developed to assess students' reactions to each written task Instructor's Manual for Psychology, 12th Edition (Wade, Tavis & Garry) Scoring index created for studying (3 points scale)	Three innovative written homework have been developed in order to teach students to think like a psychologist, and they consist of: increasing critical thinking, apply research concepts and resist to plagiarism	Results show an increase in students' ability to critically think

Campbell, C.G., & Oswald, B.R. (2018)	First course: 10 students (5 graduates and 5 undergraduates) Second course: 7 students (5 graduates and 2 undergraduates)	P-SAP Test (Fitch & Steinke, 2013)	Three series of activities and homework have been developed in order to maximize opportunities of students' engagement in reflections, and to provide a supporting structure for the use of critical thinking during such reflections	The study shows a significant improvement in students' critical thinking skills
Cammeo, C., Presteria, G., Massaro, D., Marchetti, D., Cavallini, F. (2022)	Total of 92 students enrolled in a Master Degree Course in Psychology of Clinical and Social Intervention at the University of Parma 73 of them attended lessons (attending group) 19 were non-attending students (following the course only in telematic mode, and therefore not accessing the university classroom in person)	Pre and post-test 60 flashcard containing diagnostic criteria of neurodevelopmental disorders 40 tracks of the third proof (clinical case) of the State Examination for the qualification to the profession of psychologist Textbook 10 podcasts based on 10 different clinical cases	Attending group was exposed to clinical reasoning listening to podcasts in classroom Non attending group used a more traditional methodology of studying through the textbook Both the groups completed the clinical case proof	The findings revealed an improvement in the acquisition of clinical reasoning by the group of students exposed to podcast training in contrast to their colleagues who had studied written materials

Note: Studies included in systematic review ^{Fitch & Steinke, 2013}

For the purpose of this review a large variety of instruments were used to measure clinical reasoning and critical thinking, and were classified as follows: General standardized tests (indicated in three articles); domain specific standardized tests (cited in six articles) – specifically used to measure abilities of and dispositions to clinical reasoning and critical thinking; domain specific indices, surveys or questionnaires (indicated in five articles) – usually not standardized, and of self-report type, created or used by researchers to specifically evaluate the experience of learning, that is the students' preservation of knowledge, self-confidence, satisfaction; podcast created ad hoc (cited in one article).

As for the improvement of abilities of or disposition to clinical reasoning, results have been classified as follows: general profit (++) – when a statistically significant profit in terms of a general skills set has been reported; specific profit (+) – when a statistically significant profit in terms of a specific skill has been reported; no profit (-) – when no

statistically significant profit has been mentioned, in terms of a specific ability, or a series of skills (clinical reasoning and critical thinking), or disposition.

Discussion

Population

The nine studies report a sample of 1474 total subjects, 833 of which are female and 321 are male subjects, with an age spanning between 18 and 25 (average age = 21.16; 6.08% 18 years old; 41.85% 19 years old; 0.90% 20 years old; 39.55% 22 years old; 4.19% 23 years old and 7.40% 25 years old). Unspecified were: the age and sex of a control group consisting of 119 subjects (Penningroth et al., 2007), the age of 47 subjects (Bensley et al., 2010) and the sex of 154 subjects who only participated to the initial phase of the study (Haw, 2011). All subjects attended a university psychology course. The groups varied in size; the most numerous consisted of 275 students and the less numerous consisted of seven students ($M = 98.71$; $SD = 96.32$). Among the total number of students who took part in the research, 583 were in their first year (47.94%), 362 in their second (22.20%), 273 in their third (22.45) and finally, 90 in the fourth year of the course (7.40%), ($M = 304.0$, $SD = 204.73$).

Types of intervention

All interventions involved the use of specific critical thinking teaching material (textbooks, workbooks, manuals, checklists, podcast) associated with various educational methodologies, such as: Problem Based Learning, Active Learning, Group discussion.

Four studies described non-specific methodologies which included guided discussions and group exercises, written as well as oral. One study included technological methodologies such as podcast (Cammeo et al., 2022).

Tools

In terms of the variables that were considered in this review of critical analysis, critical thinking and problem solving, different tools have been used: Standardized PCTE-Psychological Critical Thinking Examinationnaires (Haw, 2011; Muehlenkamp et al., 2015; Penningroth et al., 2007) in three studies; and CT tests (Bensley et al., 2010), Cornell Z (Solon, 2007) and P-SAP (Campbell & Oswald, 2018), each in one

study. The PCTE (Haw, 2011; Muehlenkamp et al., 2015; Penningroth et al., 2007) is the only tool specifically dedicated to critical thinking in the psychological area.

The other tools are also used in different areas. Ad hoc self-report questionnaires, in which the students had to assess their own critical thinking skills, in three studies (Muehlenkamp et al., 2015; Karantzas et al., 2013; Wentworth & Whitmarsh, 2007); furthermore, one study (Wentworth & Whitmarsh, 2007) utilized an ad hoc questionnaire to verify students' proficiency in identifying errors of thought. In two studies, different tools were used: in one study (Muehlenkamp et al., 2015), critical thinking has been investigated through students' self-evaluation as well as specific test; while in the study by Wentworth and Whitmarsh (2007), critical thinking has been investigated through self-evaluation and an ad hoc questionnaire.

Other variables under examination were: Students' motivation and participation and Learning. Students' motivation and participation have been investigated through standardized questionnaires (Bensley et al., 2010; Karantzas et al., 2013; Muehlenkamp et al., 2015); or through unstructured observation (Campbell & Oswald, 2018). In one study (Karantzas et al., 2013), learning style (CLA) was investigated, while in two studies (Bensley et al., 2010; Solon, 2007) learning of course-specific content was assessed, in addition to the general performance of the student investigated in the study of Bensley, et al. (2010).

Experimental designs

Two studies (Karantzas et al., 2013; Wentworth & Whitmarsh, 2017) have used an intra-group experimental design. Five studies are quasi-experiments where the element of random allocation, specifically, is missing. These are studies that analyze university students in different years of the course (Bensley et al., 2010; Campbell & Oswald, 2018; Haw, 2011; Penningroth et al., 2007; Solon, 2007). Finally, only two studies (Muehlenkamp et al., 2015; Cammeo et al., 2022), also structured as an intra-group study, presents a control group with random allocation.

Duration

Only one study did not specify the duration of interventions (Karantzas et al., 2013). The rest of the studies, on the other hand, can be separated in two categories: in six studies, the duration of interventions was expected to be around a semester (between 12 and 16 weeks); in the remaining two studies intervention duration would last one year (Muehlenkamp et al., 2015; Wentworth & Whitmarsh, 2017).

Results obtained by researchers

Every article measured the statistical significance of the results obtained within the specific abilities as well as other dispositions (Bensley et al., 2010; Campbell & Oswald, 2018; Haw, 2011; Karantzas et al., 2013; Muehlenkamp et al., 2015; Penningroth et al., 2007; Solon, 2006; Wentworth & Whitmarsh, 2017; Cammeo et al., 2022).

Although the majority of studies has focused on detecting changes in the target ability (critical thinking, clinical reasoning), some authors have also investigated the effects of training on other abilities or looked for correlations between the target abilities and other variables.

The results obtained by Karantzas et al. (2013) show that an approach inspired by Problem Based Learning (Barrows, 1996), integrated with Collaborative Learning Approach (Dillenbourg, 1999; Roschelle & Teasley, 1995), promotes a significant change in the perception of one's ability to critically analyse and solve problems, as seen in 273 psychology students after just 10 weeks of intervention. The intervention involved students in structured exercises where, in small groups, they had to solve daily dilemmas and/or put themselves in a familiar psychologist's shoes. Moreover, thanks to the use of the Latent Growth Curve Modelling, the study (Karantzas et al., 2013) allowed to isolate the changes in critical analysis and problem-solving abilities before, during and after the treatment from typically connected variables, such as self-efficacy, intrinsic motivation and learning style. The authors highlight the exclusive use of self-reporting tools as the main limitation.

Professors often assign writing homework to students. The study by Wentworth and Whitmarsh (2017) has the objective of verifying the efficacy of three writing tasks in promoting the typical skills of psychological thought, which are: increasing critical thinking, applying research concepts and resisting plagiarism. The writing tasks required extremely personal reasoning and analysis, so they made it unlikely and unnecessary for the student to "copy". Critical thinking has been assessed through a self-report tool as well as questionnaires in which each student had to consider a certain scenario and highlight the errors in the ways of thinking. The outcome has shown that both measures of critical thinking improve significantly from the first to the second written homework and from the second to the third, while there are no improvements from the first to the second: the authors speculate that in order to obtain a change in the variables under consideration, further exercising is needed. Besides the positive results in critical thinking, the authors emphasize the almost absence (only one student out of 456) of plagiarism behaviour in the writing homework execution. According to

the authors, the study's main limitation is found to be the complexity in isolating the training effects from the practice and exercising ones. The study by Haw (2011) focuses on the differences in the psychological critical thinking as measured through the PCTE (Lawson, 1999) in two groups of students enrolled in their second and fourth year of Psychology, respectively. Second year students, during one of their programmed courses have received, together with the subject's contents, specific instructions on critical thinking: instructions were delivered by presenting them with scenarios and group discussions. The first measurement of critical thinking was made at the beginning of the semester and, as expected by the authors, shows that fourth year students obtain a higher score than first year's; the end of semester results highlight a significant improvement for second year students and no improvement for fourth year students. The authors highlight the value of specific instructions and structured exercises about critical thinking to promote psychological critical thinking. The lack of improvement in fourth year students is, according to the authors, related to the lack of homework and exercises explicitly dedicated to critical thinking. The primary limitation of the study, according to the authors, is related to the lack of any control group. The study by Penningroth et al. (2007) is a near-experiment involving two groups of psychology students: one group received explicit instructions on critical thinking through the Active Learning mode (Bonwell & Eison, 1991), while the other group did not receive specific instructions; both groups used the same text which included a part dedicated to critical thinking. The groups were assessed with the PCTE tool, before and at the end of the course, detecting a significant difference of critical thinking improvement in the group that received explicit instructions. A similar system was implemented in the study by Solon (2007), that is a near-experiment that involve a group of students who had to work on exercises and tasks regarding critical thinking, while the other group, that used the same text which included a chapter dedicated to critical thinking, did not receive explicit instructions about critical thinking. As for the Penningroth et al. (2007) study, Solon (2007) also detects a significant critical thinking improvement in the group that received explicit instructions, and no improvement in the other one; however, Solon (2007) has made use of Cornell Z (Ennis et al., 1985; 2004), an instrument that evaluates critical thinking in general and non specifically in the psychology field. The study by Solon (2007), moreover, assessed the specific knowledge of the course in the two groups before and after intervention, and did not find significant differences: this result, according to the authors, confirms that activities dedicated to critical thinking do not reduce the opportunity to

learn specific knowledge. Also, the study by Muehlenkamp et al. (2015) is a near experiment which compares two groups of psychology students, one involved in activities of promotion of critical thinking through the PBL methodology and the other without any activity explicitly directed towards critical thinking. The results highlight significant changes in favour of the first group for the different components of critical thinking identified by the authors (high level critical thinking, processes, tools), assessed through self-report tools and the application of the principles of psychological research in critical thinking, as well as through PCTE (Lawson, 1999); furthermore, as measured with the SCEQ College Student Course Engagement (Handelsman et al., 2005) tool, the study highlights a greater involvement in students who participated in the PBL training.

For both studies, the emphasized limitation is related to the absence of a control group. The work by Bensley et al. (2010) is a quasi-experiment that involved 3 groups of psychology students attending a course of psychology research methodology; for each participant the authors assessed the critical thinking ability through the CT Critical Thinking test (Bensley & Baxter, 2006), the disposition to critically think through the Need for Cognition scale (Cacioppo & Petty, 1982), the general as well as the psychology-specific academic assessments, and through scholastic assessment tests (SAT). The procedure involved the experimental group associating the research methodology course syllabus with a series of exercises explicitly dedicated to teaching critical thinking, drawing inspiration from the text by Bensley (1998), while other groups, while using the same text, were not receiving any explicit instructions. The data suggest that the number of total psychology courses attended by each student may be correlated to the initial value of critical thinking, but the improvement in critical thinking is significant only in the group receiving an explicit and direct critical thinking training. Generally speaking, the statistical screenings that were carried out appear to confirm that is, in fact, training the element that explains the change in critical thinking, and not the initial differences regarding the variables under consideration. The study by Campbell and Oswald (2018) involved psychology students engaged in home visiting support projects for children with disabilities; the students have been assessed before and after critical thinking training, through the Problem-Solving Analysis Protocol (P-SAP) (Fitch & Steinke, 2013).

Furthermore, qualitative observations were made with regards to students' participation and satisfaction in terms of educational methods. The project consisted in associating the home visiting program, that was part of the psychology course, with three types of activities: group

discussions, supporting and reflecting on ways to promote problem solving and critical thinking, hence guided writing tasks and analysis of scenarios. Observations made in the classroom demonstrated that students were interested in participating in the activity, as considered useful and applicable in home-visiting jobs as well. Quantitative data also show a significant change in critical thinking for all those who participated in the study, highlighting the importance of such activities associated with practical experiences.

The study by Cammeo and colleagues (2022), conducted immediately after the Covid-19 pandemic, introduces the innovative element of technology through podcasts. Specifically, the group of attending students was exposed to listening to 10 podcasts containing clinical cases of minors with various neurodevelopmental disorders (including autism, learning disorder, ADHD), while the group of non-attending students studied the same scripts in a traditional paper-based mode. The results obtained from the non-parametric statistical analysis between the pre and post-tests of both groups show an improvement in all 3 variables considered: information gathering, hypothesis generation and treatment management (Daniel et al., 2019) in favour of the group of attending students who were therefore exposed to the podcast training. Finally, the study included an analysis of the percentage of agreements and disagreements in the different categories of 3 trained trainees who independently evaluated the tests.

None of the studies measured or analyzed the satisfaction of the educational method used. Every study described medium/long-term interventions (between 12/17 weeks and 12 months) in experimental or quasi-experimental projects (with control groups and pre/post-tests).

Conclusion

Critical thinking and clinical reasoning are fundamental in most healthcare professions, however it is complex to transfer these “immaterial” abilities through traditional education tested on theoretical or technical contents (Payan-Carreira et al., 2019): the collected studies present methodologies that, although different, promote significantly the improvement of critical thinking in university students, demonstrating that, beyond the limitations of the studies, it “is possible” to transfer this complex skill. The improvement of critical thinking or one of its components, namely, as considered in this review, the skill set that leads to a reflective process that translates into interpretation, analysis and evaluation of data, in order to formulate a judgement, is promoted in all the studies analysed, highlighting how explicit teaching strategies can

lead to the acquisition of complex, effective and functional skills, as well as to their transferability to work contexts.

The review of the study analysed to promote critical thinking shows that different methodologies have been used (Problem Based Learning; Collaborative Approach; Active Learning; teaching practices based on text-books educational design; review of the literature, design and research methodology; writing tasks; group discussions; homework; class tests; tools as podcasts). Such methodologies focused on different contents (theoretical contents, research data interpretation, scenarios) and, finally, have been associated with different courses (developmental psychology, research methods, etc.). Despite the methodology and content dissimilarities, results have emphasized a significant increase in critical thinking or related skills competencies. Moreover, critical thinking, as defined and measured in the studies under analysis, appears to improve regardless of learning styles, motivations, previous knowledge and academic performance. Despite the methodological limitations, mainly related to the absence of control groups and lack of follow-ups, the effect of training on the critical thinking variable seems to be evident and significant in the studies that utilised self-report tools as well as in those that used other tools.

Collecting the elements in common, it is possible to draw this series of reflections: in the works analysed the improvement in critical thinking is attributed to explicit teaching methods; the studies suggest the use of a structured program to teach critical thinking, and use educational methods that include group activities and active participation of the student.

The scarcity of the studies we found for this review does not allow us to present any general reflections; therefore, we will present some considerations that may be used as background for future research. A primary element, noticeable because related to job placement competencies, concerns the fact that issues related to generalization and transferability were not tackled in any of the articles analysed; thus, a further complexity emerges with regards to assessing the efficiency of learning strategies designed to improve critical thinking and clinical reasoning.

Most of the articles only focused on the main teaching strategy used by professors or researchers, albeit such strategy is, in all of the works, a combination of different strategies which were not always described in an exhaustive way and, in almost every case, did not present an education design logic and a theoretical framework (Bensley et al., 2010; Campbell & Oswald, 2018; Haw, 2011; Karantzas et al., 2013;

Muehlenkamp et al., 2015; Penningroth et al., 2007; Solon, 2007; Wentworth & Whitmarsh, 2017; Cammeo et al., 2022).

For instance, most studies talk about the “use of scenarios” which are not always described in detail and lack of explicit analysis of the nature of the issues or the cases to solve, as well as a guideline that allows the reader to understand the choice of using one scenario rather than another (Muehlenkamp et al., 2015; Wentworth & Whitmarsh, 2017).

Another consideration deriving from this review can be made in regards to the variety of assessment tools (tests vs. indices or surveys; standardized vs. non-standardized) used to quantify the improvements in learning the competencies studied. In accordance with Chan (2016) and Payan-Carreira (2019), every article has focused on the results from the final assessment and did not monitor changes during the learning process.

Standardized tests for critical thinking evaluation were the most used and those that showed a greater change in the pre/post test phase, while tests used to assess more general domains showed less significant margins for change.

In some articles tests were used in combination with non-standardized material (surveys or questionnaires, for instance), making the generalization of results even more complex. All the articles included in our review assessed the statistical significance (P value) as a measure of the efficacy of critical thinking learning strategies. Another complexity in the interpretation of results is related to the lack of adequate inspections and methodological strictness, given that all studies use quasi-experimental designs with practical examples, or descriptive designs without control groups, and involve only one pre-test and post-test evaluations. As suggested by previous studies (Behar-Horenstein & Niu 2011; Lapkin et al. 2010; Oliveira et al. 2016; Payan-Carreira et al., 2019), future research would have to engage in planning experimental designs which include random assignments inside the groups and, possibly, measures of change during the training. The study by Cammeo and colleagues (2022) introduces teaching methodologies that make use of technology. This strand could be useful in the planning of courses and teaching materials that can also be used at a distance.

This review is intended as a basis for designing researches aimed at investigating the impact of the different methodologies as well as a starting point to urge reflections on the possibility of including critical thinking education within the different training levels dedicated to psychologists.

Continuing on findings, this review suggests that learning strategies that actively involve students might be of preferable to traditional

lectures for the promotion of critical thinking and clinical reasoning. However, the presence of a limited number of studies associated to the lack of a solid theoretical background and the diversity of evaluation tools, compromise the comparison of the efficacy of the described learning activities. Therefore, using the studies' limitations as practical suggestions for future studies, we may advise the following: studies will have to be carefully designed from the methodological point of view; will have to be described in a way that is more operationalized and replicable in terms of the roles of facilitator, eventual learning tutors and students; and it will have to explain the type of materials in use, their sequence and presentation modes. Further research should concern: threats to the internal validity (for example, by at least opting for quasi-experimental projects with randomized sampling), the use of larger samples; being cautious in terms of controlling variables, such as age, gender, academic performance, pedagogical knowledge of the teachers. It is also fundamental that future studies gather information on transferability or generalization of improvements in the workplace or in the structures where the student moves after graduating.

As a starting point for professors and practitioners who work on training clinical psychologists, there is plenty of room for innovation: every scenario in use is read or told by the professor or the facilitators, and they do not implement technological solutions, such as podcasting, videos, or artificial intelligence systems that could make the situation more realistic and, perhaps, enhance learning. Furthermore, it would be useful to include qualitative surveys to explore what are the salient variables in the clinical reasoning process from the students' point of view and to extend the interventions to other professionals in order to work in a systematic way.

We believe that research should continue in this direction, because agencies interested in health care professional training (i.e. Professional Associations, Universities, Training Agencies, CME Providers and psychotherapy schools), as well as especially public and private health-care facilities that welcome postgraduate psychology trainees and/or are interested in developing professional collaborations, expect that graduates not only master the scientific and technical core knowledge of the profession, but also possess advanced thinking capabilities, that allow them to engage in clinical reasoning processes that are essential in the health and care sector (Aglen, 2016; Cavallini et al., 2019; Hildenbrand & Schultz, 2012).

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