"ALEXANDRU IOAN CUZA" UNIVERSITY OF IAŞI

DOCTORAL SCHOOL OF PSYCHOLOGY AND EDUCATIONAL SCIENCES

Ph.D. Thesis SUMMARY

DEVELOPING CRITICAL THINKING IN EDUCATIONAL CONTEXTS

A psycho-educational approach

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Preamble

The present doctoral thesis is a paper-based thesis that comprises a series of four scientific papers (Paper I to IV) published or submitted to peer-reviewed journals. The thesis has a total of six chapters. The 1st part comprises the introduction and the methodology of the thesis (Chapter 1 and 2). The 2nd part comprises the core paper representing the theoretical structure (Chapter 3) and the empirical structure (Chapter 4). The 3rd and last part comprises the discussions (Chapter 5) and conclusion (Chapter 6) of the thesis.

The main papers (Paper I and Paper II) are reproduced as accepted publications with the tables, figures and numbering from the original journal papers, integrated into the general content of this thesis. The language changes between British and American English are due to the journal's requirements where the articles are published. The default language of the thesis is British English.

Brief summary of the thesis

Being a concept with large applicability nowadays, Critical Thinking gained notoriety by its implication in daily lives, in the process of decision making and continuous learning. Thus, it is essential to create new understanding in bridging educational context, responsible for formal education and the necessity of developing skills such as Critical Thinking. This thesis aims to pose and answer the following question: *How can Critical Thinking skills be measured and developed in a process that acknowledges both skills development and knowledge acquisition in educational contexts?* In order to answer to that research question, four research papers were completed as follows: PAPER I, a narrative review, offers a triadic approach (i.e., philosophical, psychological and educational approaches) about definition, programs and measurement tools for Critical Thinking; PAPER II, a narrative review, comes with additional information about the factors and educational practices that influence Critical Thinking development; PAPER III, empirical studies that aimed to check the psychometric validation of Critical Thinking test and PAPER IV, an empirical quasi-experimental study, that designs and reports on an instructional intervention which aims to develop Critical Thinking skills among university

students. Results of the thesis showed that Critical Thinking can be developed in formal education by using a suitable framework such as Anticipation, Realisation and Contemplation (ARC), and student-centred teaching approach that allow students p3to be actively engaged in their learning. The main theoretical contribution comes by the broad overview over the Critical Thinking definition, the measurement and the skills development. Another contribution is related to the Critical Thinking measurement where a standardised test is proposed (i.e., The Romanian Critical Thinking Test - RCTT) that offers a model of construction of a Critical Thinking test culturally adapted. More theoretical contribution is made by the detailed description of an instruction intervention student-centred, designed to develop Critical Thinking among university students. The practical contribution of the thesis consists of suggestions and recommendations for the use of RCTT by practitioners in the educational field, and by the specified description of the student-centred approach that was confirmed to develop Critical Thinking skills.

Acknowledgements

I consider this part of the thesis very important as here I present the supportive people that helped me during the research process. Their support and trust have shaped my research in this thesis and I want to acknowledge and thank each of them. I would like to clarify that I am grateful to all the people that will be mentioned in the next lines. I, however, do not acknowledge a specific order of supportive people as each of them helped me in different periods and ways throughout the research process.

I am truly grateful to my supervisor, Professor Dr. Nicoleta Laura Popa who accepted to take the role of advisor of this thesis in Educational Sciences. I am grateful to her for her confidence in my strength of conducting a thesis in Educational Sciences while at that time I only had an academic background in Psychology. I am now in the process of graduating with a bachelor degree in Educational Sciences and I am grateful to my supervisor for inspiring me and for encouraging my external research experience (Erasmus Mobility). It is for this knowledge that I managed to grow as a scholar.

I would like to extend this gratefulness to "*Lectura şi Scrierea pentru Dezvoltarea Gândirii Critice*" Association,

other researchers and professors that brought their contribution and advice to my research journey.

I am wholeheartedly grateful to my family who helped me to overcome barriers and sad times throughout the research process. This extends to people that became my "extended" family throughout the years, great colleagues, Dr. Andreea Ursu and Dr. Tina Vrabie as well as close friends, Dr. Mădălina Pană and Dr. Ana Maria Hojbotă. Their feedback and friendship helped me to develop my research. Their implications and encouragement helped me to have the doctoral thesis I planned for. To all my other friends I am grateful for their presence in different moments of my life.

My thanks also go to those that shall remain anonymous, participants to the research who contributed to the data collection of the thesis. I acknowledge and thank them for each of their roles in my research process. To all the others who are by default anonymous reviewers of my work, I thank them for their work and suggestions that helped me develop my research work.

Thank you everyone for being part of my doctoral thesis! Thank you for joining my journey and for making what started as a lonely and challenging process to become an opportunity for learning how to ask and receive support and feedback.

TABLE OF CONTENTS for the extended thesis

Chapter 1: INTRODUCTION

The first chapter provides an overview of the topic and research problem addressed in the thesis. Its structure consist of the main background, terminology, the research problem and question and an overview of the thesis structure.

Starting from the beginning, Critical Thinking literature has come a long way in describing the centrality of the concept for our daily lives. The centrality of Critical Thinking is visible in our decision making and continuous learning. Nonetheless, new understanding has to be created in bridging the educational context with the development of Critical Thinking skills.

Generally speaking, in Romania, the discussion on the development of Critical Thinking skills began when the American association for Reading and Writing for Critical Thinking (RWCT) opened a subsidiary with a role in developing educational programs that align with developing Critical Thinking skills. At the international scale, World Economic Forum (2020) conducted research across countries and presented a list with top 15 skills for the 2025 labour market. In this top, Critical Thinking takes the 4th position. It also has a place on the *emerging skills* list and as a "*current skill in focus of existing reskilling/upskilling programmes*" even when the surveys were performed in a "pandemic economy" (World Economic Forum, 2020, p. 8).

At the research interest level, three literature fields have strong perspectives on Critical Thinking: Philosophy, Psychology and Education (Bailin, 2002; Bunge, 2010; Colebrook, 2017; Lewis & Smith, 1993). The three perspectives bring their unique contribution to the understanding of Critical Thinking. Philosophy approaches Critical Thinking in terms of attitudes of an ideal

critical thinker, Psychology approaches the skills that can be measured and Education presents the overall objectives for developing Critical Thinking skills. The focus on this triadic approach is motivated by the specific contribution that each perspective has for the educational context.

The definition and the measurement of Critical Thinking have been intensively discussed throughout the Critical Thinking literature (Moeiniasl et al., 2022). Specific studies highlight Critical Thinking as being composed by skills and dispositions (Abrami et al., 2008). For measuring Critical Thinking according to the definition introduced in the previous paragraph, we have access to instruments that acknowledge the components embedded into the concept. In addition, we need to use insights from such perspectives for developing valid tests that acknowledge several aspects that might contribute to Critical Thinking. The lack of such knowledge creates difficulties for understanding all the sides of Critical Thinking and for having an objective capturing of the Critical Thinking skills for students from a specific culture, i.e., the Romanian culture.

In overcoming the existing gaps and problems created by the lack of a standardised measurement of Critical Thinking skills that acknowledges the local cultural background of the participants and the lack of detailed information about interventions aimed at developing Critical Thinking skills, the following research question is proposed and answered in the thesis:

Research Question:

How can Critical Thinking skills be measured and developed in a process that acknowledges both skills

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development and knowledge acquisition in educational contexts?

In replying to the research question, we start from the understanding of the concept of Critical Thinking and the main research fields where education can be encountered. We explore the definition, the measurement and programs of development (Paper I). Knowing the definition, how it was measured and the developing programs was, however, not enough to form the theoretical background for the thesis. The literature mentions some variables that may influence the level of Critical Thinking that can be acquired. Such variables are named as the contextual factors, teaching and instructional approaches, educational practices, and teaching methods that can be performed during class teaching, aiming to develop Critical Thinking (Paper II). After we define Critical Thinking and we know what factors it may influence its development, the next step is to measure Critical Thinking in a standardised way. That was the result of Paper III that validate the Romanian Critical Thinking Test. Last but not least, in our way to answer the second research question, we designe an instructional intervention that had the purpose to find what teaching approach had a significant influence over Critical Thinking development (Paper IV).

This thesis comprises four papers (Paper I, Paper II, Paper III and Paper IV), two theoretical studies and two empirical studies. Paper I consists in a narrative review of Critical Thinking literature from the perspective of three approaches, philosophical, psychological and educational approach. This narrative review covered the definition, developing programs and measurements of Critical Thinking under the philosophical, psychological and educational approche. The second theoretical study, Paper II,

consists in a narrative review covering the Critical Thinking literature between 1940 and 2017 onto contextual factors, educational practices and teaching methods that develop students' Critical Thinking skills. The first empirical study of the thesis, Paper III, is represented by a psychometric validation of the Romanian Critical Thinking Test, a Romanian instrument suitable for measuring Critical Thinking. The second and final emprical study, Paper IV, is a quasi-experimental study focused on finding the answer to the research question *"How does the instruction influence the development of Critical Thinking skills?"* In order to answer this specific question, we proposed a systematic design for an instructional intervention where two approaches in teaching were compared, student-centred and teacher-centred approach in teaching.

Building on the results from each paper, the answer for the research question was developed. In Figure 1, the specific link between the papers is depicted.

Figure 1: The link between the papers of the present thesis
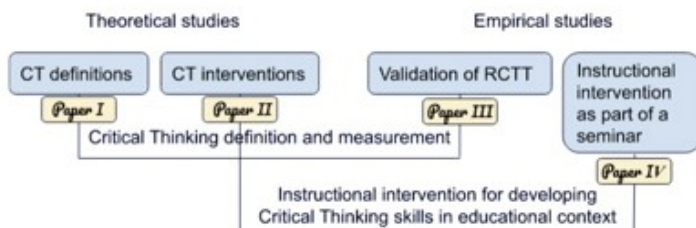
Chapter 2: OVERVIEW OF THE RESEARCH METHODOLOGY

This second chapter presents the entire methodology used in order to answer to the research question of the thesis. The four papers presented in this thesis are based on different research methods that correspond to individual research aims and questions. The research methods are narrative review (PAPER I and II), psychometric validation (PAPER III) and quasi-experiment (PAPER IV).

For PAPER I we used the narrative review as we were driven by our particular aim to make a comparison between the philosophical, psychological and educational approach. In PAPER II the narrative review was suitable because we followed the particular contextual factors that can influence the Critical Thinking development, the educational practices and the teaching methods used in empirical studies for develop the Critical Thinking (Green et al., 2006).

The psychometric validation of Romanian Critical Thinking Test (RCTT) used in PAPER III consisted in checking various types of validity and reliability (Hogan, 2019). Thus, we conducted three different empirical studies to verify the internal structure and content validity (Study I), the convergent and discriminant validity (Study II) and the reliability (Study III) of the RCTT.

The last PAPER (IV) uses a quasi-experimental design with pre-test post-test assessment of the level of Critical Thinking skills of participants assigned in two groups - experimental and control groups - to check whether the student-centred or teacher-

centred teaching approach is more effective in developing Critical Thinking in formal education.

Chapter 3: THEORETICAL BACKGROUND
3.1 PAPER I - Critical Thinking definition, programs and measurement tool

Comprehension View about Critical Thinking - Narrative Review[1]

The Critical Thinking literature emphasizes the continuous need of understanding the meaning of a complex concept as Critical Thinking. Previous research provides multiple theoretical approaches on Critical Thinking, including different theoretical and operational definition, methods for developing Critical Thinking and measurement tools within formal education. In this study, we focus on reviewing the main insights from previous studies with the specific aim of proposing a structured overview of how Critical Thinking can be defined, developed and measured according to multiple approaches (i.e., philosophical, psychological, educational). Results of this study showed the development of the Critical Thinking concept, consisting of a broad perspective of multiple approaches. This further enables an overview of Critical Thinking particularities.

During the study, the focus was on the chronological timeline of definitions, taxonomies, training programs and measurement of Critical Thinking. Firstly, we provide a comprehensive overview of the initial approaches of Critical Thinking. As a starting point, we reviewed the implications of Gubbins' Matrix in inventorying the thinking skills based on empirical research (*1985 as cited in Sternberg, 1986*). We continued by presenting the insights on Critical Thinking from three fields: 1) philosophy, 2) psychology, and 3) education. For each field, we presented the main taxonomies, chronological definitions and the development of Critical Thinking as research stream. In addition, we provide an overview of a critical event in the development of Critical Thinking as concept. The Delphi Research Project created a gathering event that connected experts from several fields for providing a consensual definition, a set of skills and dispositions of Critical Thinking (Facione, 1990). Based on insights provided because of this event, we presented a complex operational framework that connects the approaches from the three investigated fields (Thomas & Lok, 2015). After we internalized all these information, we proposed a definition for Critical Thinking *"an umbrella concept that gathered under his spectrum personality dispositions and cognitive skills all mixed and applied to daily life knowledge"*. We found this definition integrative and facilitative for a better understanding of Critical Thinking concept.

Further, we observed that Critical Thinking is a studied concept in adjacent fields such as philosophy, psychology, or education. Even those domains are part of social sciences, the concept was addressed distinctly. Despite the interest of all three fields for Critical Thinking, the discussions and approaches of

Critical Thinking differ. In **philosophy**, the Critical Thinking insight consists on dispositions or personality aptitudes of an *ideal critical thinker*. Here, the definition of Critical Thinking developed in a chronological order from reasonable and reflective thinking (Ennis, 1985), followed by responsible and skillful thinking (Lipman, 1988), purposeful judgment, self-directed and disciplined thinking, (Paul, 1992); purposive and goal-directed thinking (Bailin et al., 1999), reflective judgment (Facione, 2000) and reflective skepticism skill (McPeck, 2016). We can conclude that the keyword used in the philosophical approach is *reflective*.

In **psychology**, the Critical Thinking insight consists on *skills and behavior of a critical thinker*. The definitions of Critical Thinking started from mental processes (Sternberg, 1986) to cognitive skills (Halpern, 1998) followed by disciplined mental activity (Huitt, 1998) and skills such as problem solving, drawing conclusions and openness to new proves against own initial ideas (Willingham, 2008). Here, the main keywords are *skills* and *behavior*. Notable here is the base skill of a critical thinker, i.e., the openness and acceptance having wrong ideas. No other approach has considered those aspects regarding self-ideas that are important in everyday life. We consider that the **education**al field approached Critical Thinking in the most applicable way with educational objectives and direct observations of Critical Thinking. Here, Critical Thinking is *a jointing between knowledge and skills*. The main interest of specialists from education, consisted of the application, transfer and use of Critical Thinking in real life. The main keyword here is applied *knowledge*.

We also brought into discussion, following the same triadic approach (philosophical, psychological, and educational),

the proposed programs for improving Critical Thinking. We considered here all the programs starting from primary school to university level and added insights about the lifelong learning.

The last phase of the review involved discussions on measurement of Critical Thinking. Differences were observed between measurement of Critical Thinking in each of the three fields. In philosophy, the proposed tests had time limit and right or wrong responses (Ennis & Millman, 1985; Watson & Glaser, 2002). In psychology, we observed a preference for open-ended questions without time limit (Halpern, 2007). Similar types of tests, open-ended and without time limit, were observed for the specific view on Critical Thinking in education approach (Lopes, Silva & Morais, 2019).

In conclusion, this study provides a conceptual overview of Critical Thinking from the three main domains interested in this concept. This involves a comprehensive and chronological view on definitions, skills structure, proposed taxonomies, developing programs and measurement instruments. This approach facilitated our process of proposing the following research: What are the following phases that could facilitate our approach and development of Critical Thinking in education field? To respond to this question, we propose a further review with specific focus on teaching methods and strategies of developing Critical Thinking. In this way, we will further the overall understanding of *what is* and *what are the methods to develop Critical Thinking*.

3.2 PAPER II - factors that influence Critical Thinking development, educational practices that develop Critical Thinking

On developing Critical Thinking: a narrative review[2]

This study provides an overview on the contextual factors, educational practices and teaching methods that develop Critical Thinking on students. To provide this overview, we synthesized the meta-analysis and reviews of studies published between 1940 and 2017. For outlining the contextual factors, we present the three levels that promote or inhibit Critical Thinking: (1) institutional level, (2) teaching level, and (3) course level. We further synthesized the literature on educational practices that develop Critical Thinking and outline the teaching methods from three categories: (1) oral (e.g., debate, dialogues etc.), (2) written (e.g., argumentative essay, concept mapping etc.), and (3) applied (e.g., experiential learning, problem solving etc.). This literature review study provides theoretical implications for the literature on Critical Thinking. These implications consist of an overview of the contextual factors, educational practices and teaching methods that develop critical thinking.

Being a trendy concept for the 21st century, because of its practical implication as the ability to discern through true and false information, by making informed decisions, Critical Thinking (CT) enjoys serious representation in the literature. In this study, we initially presented the contextual factors that promote or inhibit CT (i.e., institutional level, teaching level and at the course level) and Ennis's course approach to teach CT (i.e., general, infusion, immersion and mixed). To enable a complex overview on CT development, we emphasize the instructional approaches (i.e., individual study, dialogue, authentic or anchored instruction, mentoring or coaching) with positive effect over CT outcomes (Abrami et al., 2015). We further synthesized the meta-analysis and reviews of studies published between 1940 and 2017 related to educational practices that develop CT. Lastly, we gathered the results from meta-analysis, reviews and studies on specific teaching methods that develop CT in higher education, and we organised them in three categories (i.e., oral, writing and applied). It is necessary to take in consideration the contextual factors that has the power to promote or inhibit CT. These factors besides Ennis's approach to teach, and the instructional approaches form the necessary environment where CT can be developed.

The main results observed after reviewing and analyzing how CT was studied in the '40s to '90s literature, showed how the concept evolved over the years. First, it begins with basic questions such as: the specificity of the CT skills, the generalizability and transferability of CT skills from one domain to another. It continued with the way that these CT skills should be taught (i.e., in the same subject area or separately) at which age we teach such skills and closed up with the need for the teacher's

training on CT principles in order to understand the phenomenon and be prepared to teach/apply it in the classroom. Further, new research brought the CT concept as an aim of education and the theoretical ground filled with a constructivist learning environment and social constructivist approach. Concluding the results from teaching methods used over the years in obtaining gains in CT we can observe that in the beginning of the research there was a lack of studies to show the most effective teaching methods that develop CT. Overall, prevail the methods that use interaction (eg. small group discussion, group work, activities in cooperative groups, small group teaching and active learning techniques) among real-world problem exercises, guided practice, scenario-based course exercises, and teacher higher cognitive questioning, designing situations where students make inferences methods as fish bowling, problem based learning, teacher modeling, scaffolding, role playing and lecture discussion teaching, all those methods contributes to gain CT.

Concluding on the teaching methods found to develop CT, we could infer that oral interaction are the most frequent way to develop CT. Applied activities are the next numerous in terms of methods that develop CT. These results are due to the fact that CT skills are interconnected to the applied to every day situation. Finally, the least numerous activities, the written ones, conclude the multitude of activities offering methods based on writing, thus covering the entire educational activities.

The theoretical implication of this study consists of providing a synthesis of the overall aspects that contribute to CT development. This further enables a conceptual understanding of what helps and what should be considered in the research of CT development. Research should further consider the contextual

factors, the educational practices and teaching methods when evaluating the educational process of developing CT. The paper enables this approach by presenting each relevant contextual factors, educational practices and teaching methods that facilitate such efforts. Knowing more, an ideal CT instructor will take care to integrate CT into subject area instruction by using it as content for the application of CT skills. Moreover, the instructor will support the students to engage them in the transfer and generalization process of CT skills to many contexts (Facione, 1990). In the end, the open question remains whether higher education enhance CT skills and how (Dwyer & Eigenauer, 2017; Huber & Kuncel, 2016)?

Chapter 4: MEASURING AND DEVELOPING CRITICAL THINKING IN HIGHER EDUCATION. EMPIRICAL STUDIES

4.1 PAPER III - psychometric validation of a Critical Thinking test

The Psychometric Validation of the Romanian Critical Thinking Test (RCTT)[3]

Critical Thinking is a well known key competence for lifelong learning. This paper presents the validation of the Romanian Critical Thinking Test (RCTT) through the analysis of its psychometric properties. Based on a large sample size of students, we conducted three statistical studies for evaluating the psychometric properties of the test: the internal structure of the test and content validity (Study I, $N=461$), convergent and discriminant validity (Study II, $N=281$) and the test-retest reliability of the test (Study III, $N=276$). Overall, the results showed support for the reliable and valid measurement of Critical Thinking skills with the Romanian Critical Thinking Test. We discuss the added value of this new scale in the context of the local Romanian culture. Further directions include a specific focus on the complexity of capturing Critical Thinking (CT).

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3   The information presented in this subchapter will be subscribed under the following reference:

Buzduga C. A., Dominguez C., Morais E., & Havârneanu M. G. (working manuscript). The Psychometric Validation of the Romanian Critical Thinking Test (RCTT)

This study aimed to validate the construction of the RCTT by investigating the psychometric properties. We collected data from a large sample (all three studies $N=1,018$) of students from the same university and different faculties within the Social Sciences field. The RCTT was validated in three studies using samples from three consecutive cohorts of students.

In Study I, we aimed to check the internal structure and content validity. The findings in this study are in line with previous results consisting of similar intercorrelations between subtests and CT ($r=.58$; Hassan & Madhum, 2007). This suggests that the subtests (i.e., Inferences, Recognition of assumptions, Deduction, Interpretation, Evaluation of arguments) represent a good representation of the CT skills. In other words, it is a good premise for us to draw on such subtests and skills for measuring CT. The internal structure was analyzed through the item - subtest score correlation, demonstrating a good fit for the items. The content validity verified through subtests' correlations demonstrated a stable structure. This advances the knowledge on measuring CT through proposing the measurement of specific CT-related skills with a situational test that considers the cultural context of the participants. Study II demonstrated the convergent and discriminant validity of the RCTT. The convergent validity was demonstrated through the significant and positive correlation between CT and a distinct construct from the same area of higher order cognitive skills (i.e., IQ). These results are aligned with previous research demonstrating a positive association between two cognitive skills such as IQ and CT (Buzduga, 2018). The discriminant validity was demonstrated through the negative correlation between CT and Persistence. The persistence construct was selected due to the specific distinction

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between being motivated to conduct regular tasks, as measured by the persistence scale, and being motivated to perform cognitive tasks such as those required by the CT assessment. In measuring both constructs, persistence and CT, we supposed that people who tend to be persistent in their daily tasks do not necessarily have dispositions towards using their CT skills. The result confirmed that CT measured through the RCTT is a separate construct than persistence as the two of them belong to separate domains, CT to the cognitive domain and persistence to the conative domain. This result could be explained by the specific nature of the persistence and the overall effort required by the CT. Being persistent in daily activities does not provide the basis for being persistent in cognitive tasks. This suggested that the specific efforts for regular and cognitive activities are different. In the specific case of CT usually referred to as skills and disposition, has a high, cognitive level. Thus, the negative correlation between persistence and CT can be explained by what motivates behavior, an activity task versus a cognitive task. Our work advanced the stream of knowledge on CT (Lun et al., 2010; Orhan, 2022) through creating strong support for considering CT as a unique and complex construct, captured through tests that consider the context of measurement, such as the culture, and having a strict cognitive dimension.

The results of Study III (r=.43) are in line with Behrens' (1996) study (r=.42) on conducting a test-retest application of WGCTA in order to verify the reliability of the test. Our test-retest correlation showed a significant moderate correlation that led us to conclude that the RCTT meets the required condition to be accepted as a reliable test. We assume that the moderate and significant value for the test-retest correlation is due to the long

time (eight months) between the two measurements. This was, nonetheless, set to diminish the probability that participants would learn the items and the correct answers.

After gathering all the results obtained in all three studies, we concluded that the RCTT can be considered a valid and reliable test to measure CT skills. Thus, our efforts in validating the RCTT extended the literature on CT (Anders et al., 2019; Moeiniasl et al., 2022) by exploring how CT can be measured using tests that consider the culture of the country. By assessing the suitability of the RCTT in measuring CT in a Romanian sample we contributed to the literature on CT by extending the specific knowledge on measuring CT through situations adapted to the local and regional culture. Thus, the validation of RCTT extends the previous efforts by proposing new and locally applicable situations while keeping the focus on CT as a complex skill-set.

These initial steps in developing European tests that measure CT with objective items, starting with a Romanian version, pave the way for further adaptations to other European countries. These initial insights extend the current knowledge on CT by enabling a new perspective suggesting CT should be assessed through situational tests that are culturally adapted to the populations and encouraging other researchers in Europe to further adapt this version.

4.2 PAPER IV - instructional intervention for developing Critical Thinking

Developing Critical Thinking in formal educational contexts: an instructional intervention with university students

There is an increasing and openly expressed need for developing Critical Thinking in formal higher education contexts. This is especially relevant due to the need of having students skilled in thinking critically and developing cognitive skills in a complex and rapidly changing world. Nonetheless, the literature on Critical Thinking has still to provide good examples for instructional interventions that effectively develop Critical Thinking skills as part of the learning process, at all educational levels. This study explores teaching approaches and instructional designs that could lead to university students' Critical Thinking skills development in educational contexts. Starting from the understanding of the Critical Thinking concept, particular teaching strategies and other variables that empirical studies present as influencing factors for Critical Thinking growth, we designed an instructional intervention of eight weeks to check the effects of the student-centred and teacher-centred approaches in teaching on the development of Critical Thinking skills. Our sample consisted of university students ($N=90$), divided in two groups that received mainly the student-centred (experimental group) and teacher-centred (control group) approach in teaching. Results showed support for the student-centred teaching approaches in developing Critical Thinking skills. Based on these outcomes and in line with previous similar studies, we further advocate that teachers should consider students as active agents in

their learning process, which in turn should aim explicitly at the development of Critical Thinking skills. The literature on Critical Thinking development can use these insights for designing educational contexts with a specific focus on Critical Thinking (CT) skills development.

This study aimed to find the answer of the research question: *How do instructional practices influence the development of CT skills?* In designing the instructional intervention we take into account the findings of Tiruneh et al., (2014) showing that a successful CT instruction depends on particular aspects such as a standard measurement for assessing CT (Abrami et al., 2008), specific instructional approach (Ennis, 1989) and specific teaching strategies (Beyer, 2008). By using a standard measurement for assessing CT, the need of having operational definitions and standardised measurement for assessing the CT level was highlighted (Liu et al., 2014; Watson & Glaser, 2006). We aligned with this perspective and used the Romanian Critical Thinking Test (RCTT), a standardised instrument to measure the CT. For aligning with the use of instructional approaches that are specific for CT skills development, we followed a specific CT instructional approach that refers to four particular approaches to develop CT skills as part of the instruction (Ennis, 1989). The four instructional approaches are general, infusion, immersion and mixed instructions. Within each approach, the learning objectives, lecture content, teaching specificity and general principles of CT are essential characteristics that define the instruction (Ennis, 1997). Following Tiruneh et al. (2014) results, we used the approach of immersion for the experimental group. The learning objectives from the immersion are implicit, meaning that in this

instructional intervention, the objectives were developed by and kept only for the knowledge of the teacher. This suggests that students were not aware of the learning objectives or CT principles of development consisting of acquiring the CT skills once the students will be engaged in instruction. On the other hand, the teacher developed the seminar according to such CT principles of development (Ennis, 1989). After applying the specific CT instructional approach (i. e., CT principles of development, Ennis, 1989) we applied different teaching strategies (teaching methods and techniques), we considered the drivers that develop CT (King, 1994) and the barriers that inhibit CT (Sternberg, 1987).

Furthermore, to answer the research questions, we designed a quasi-experiment with university' students (N=90) and proposed a hypothesis that assumes the specific role of student-centred teaching approaches in developing CT skills. Results confirmed first that the student-centred teaching approach develops a significantly higher level of CT skills, and second that age has a critical impact in CT skills development. These results align with previous findings showing that teaching strategies such as problem-based learning, concept mapping and group work, used among immersion (a CT instructional approach), improves CT skills (Davoodi et al., 2022; Hmelo & Ferrari, 1997; Orhan & Ceviker, 2022; Semerci, 2006; Steele et al., 1997). More precisely, Hmelo & Ferrari (1997) and Semerci (2006) stated the importance of problem-based learning in developing higher order thinking skills. In this study, we extend these insights by showing how problem-based learning applied in a student-centred teaching approach within an immersive CT instructional approach impacts the development of CT. Moreover, Davoodi et al., (2022) stated

that concept mapping implemented in a student-centred teaching approach develops CT. This was acknowledged in our study, where the experimental group that was involved in several activities including the concept mapping achieved a higher level of CT at the end of the experimental intervention. These results are explained by the high responsibility that students get while they are an active part of the seminar work. They are engaged as an active part which makes them responsible for working in reading the material and preparing upfront. Such responsibility makes students think and rethink the work material, which is a cognitive effort where the CT skills are used.

Results further showed an effect of age on CT skills development. This means that, with the increased age, the level of CT skills improves. This effect can be explained by the increased experience that people get while using the cognitive skills that ground the CT. Previous studies have found and discussed the link between age and CT skills development (Buzduga, 2018). Our research supported these discussions suggesting a link between CT skills and age among students enrolled in bachelor studies. This could be explained by the increased level of knowledge and effort that the students direct towards the learning process. Once they advance in their seminar work, they are required to learn and contribute more which in turn makes them more prone to develop their CT skills. Nonetheless, our research opened this discussion suggesting a link between CT skills and age among students.

The study contributes to both theory and practice in CT skills development. In terms of theoretical contribution, we enriched the CT literature (Abrami et al., 2008; Ahuna et al., 2014; Bellaera et al., 2021; Sato, 2022; Tiruneh et al., 2014) by

offering the details of an instructional intervention for university students. This enables students to develop knowledge and CT skills as part of the learning process in their study program. The results of this study emphasise how some simple tools used in the learning process, such as questioning and problem-based learning, are important (King, 1994; Schmidt et al., 2022). Moreover, Vaughan and Estes (1986), stated that there is a close relationship between the quality of questions asked by the students and the quality of questions asked by teachers. This implies that adequate stimulation through meaningful questions from the teacher's side will engage students to think deeper. Besides, students challenging questions can also engage teachers. The role of questions is to stimulate and stretch the student's thinking. In this way, they guide students to analyse prior understanding, to synthesise the information by determining the relation between the concepts, and to critically evaluate their understanding about concept's relationships (Vaughan & Estes, 1986). Another teaching technique, the feedback, can have the power to offer a clear view over the knowledge of how a skill was achieved.

Our study aligns with the direction of the Open Society Institute (OSI), which promotes the student-centred approach as a democratic practice for teaching within an open society (Belova, 2020; Pupovci, 2003). As a plus, our study shows specific examples of teaching strategies which proved to be suitable for teachers that are engaging or planning to engage in CT skills development to their students. In terms of practical contribution, we offered examples of teaching methods and techniques that contributed to create an adequate learning context where student's CT skills can be developed. We proposed that further designs for instructional intervention should be developed based on three

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main conditions: 1) teaching and student involvement should be combined within seminars; 2) students should become an active part and participate in the teaching and learning processes; 3) CT skills should be developed in the same time with learning the subject matter, as part of the learning objectives. Teachers should therefore act as moderator between the learner and the content to be learnt (acquiring new knowledge).

Chapter 5: DISCUSSION

The thesis combines theoretical insights and empirical results for creating the understanding of Critical Thinking development in educational contexts. Each paper presented in the thesis makes its unique and important contribution towards this understanding. Paper I sets the overall understanding of Critical Thinking definition and measurement from three disciplinary fields. Paper II gives the overall view of the teaching methods and contextual factors for developing Critical Thinking. Just as those two papers provide theoretical knowledge, the following two move beyond this knowledge to measurement and testing. Specifically, Paper III refines the definition and measurement of Critical Thinking (based on the insights of Paper I) by presenting the validation of an instrument that measures Critical Thinking skills acknowledging the local context of participants, i.e., items including real-world stimulus that the participants can relate to on a cultural level. Paper IV extends the knowledge from Paper II by presenting a feasible intervention that develops Critical Thinking skills in an educational context. Below, I highlight the theoretical and practical contribution of the thesis.

5.1. Theoretical contributions

The present thesis brings theoretical contributions to Critical Thinking literature. The three-pronged combination of insights from Philosophy, Psychology, and Education allows a broad overview and indeed conceptual and empirical capture of the definition, measurement and development of Critical Thinking skills. Specifically, Critical Thinking has long been described in terms of cognitive skills and dispositions (Facione, 1990), with this focusing on Critical Thinking as a set of cognitive skills. Previous research demonstrated limited means for measuring Critical Thinking (Moeiniasl et al., 2022), and in this thesis I discuss the possible implications of developing and applying a Critical Thinking test that has cultural implications. Thus, the thesis extends the Critical Thinking literature by providing specific insights on a test that is culturally adapted. This specific type of test can be developed and adapted for other cultures, enabling an in-depth embeddedness in the lived experience within particular cultures, allowing a deeper understanding of how to measure Critical Thinking.

Another theoretical contribution stems from the intervention in developing Critical Thinking skills in educational contexts. Previous studies provided initial indications as to how to design and conduct such interventions (Jonassen, 1997). In this thesis, these insights are extended through presenting a specific teaching approach, i.e., the student-centred approach. This can further enable the development of frameworks that treat Critical Thinking skills as a feature integrated within educational experiences in different fields and topics.

5.2. Practical contributions

Several practical contributions can be drawn based on the results presented in this thesis. Practitioners seeking to develop Critical Thinking in the educational contexts (i.e., teachers and academics) should consider first the need of understanding the definition of Critical Thinking, selecting and using standardised measurements adapted to the local context of the students; that is to say, to design interventions that are student-centred and consciously directed towards developing the Critical Thinking skills. In understanding the definition of Critical Thinking, practitioners should consider the insights from the triadic approach drawing on the disciplinary strands of Philosophy, Psychology and Education. Other disciplines have much to offer, too, but the humanistic modality of Philosophy, the behavioural science of Psychology, and the applied social science of the study of Education offer a rich and in many ways natural interdisciplinarity. Through these compounded lenses, practitioners can acknowledge the complexity of Critical Thinking and combine angles of insight; to foreground the ideal critical thinker is consistent with a philosophical outlook, to measure Critical Thinking skills stems from psychological observation techniques, and the design of objectives and interventions is inherent to educational praxis. In using measurement tools, practitioners have to assemble and deploy standardised measurements that capture what they want to measure. In this thesis, a standardised test focused on Critical Thinking skills (as opposed to dispositions, which might provide an alternative and complementary approach) is provided for the

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use of practitioners from the Romanian educational context with items that acknowledge the local cultural background of students.

In designing an intervention for developing Critical Thinking skills, the thesis would suggest that it is advantageous to implement a student-centred teaching approach. This consists of designing instruction in which practitioners build on the pre-existing knowledge of the students, encourage students to be an active part of the learning process and support the students' process of combining and revising information, including that they already possess, for creating knowledge. This specific process is referred to as the Anticipation-Realisation-Contemplation (ARC) framework. Thus, the seminar, course or lesson should be designed by building on students' existing knowledge in order to accommodate the new knowledge. Students will be actively involved in acquiring knowledge through active learning. Hence, students will be able to make sense of the new acquired information. In using the ARC framework, the practitioners check the content of the course/seminar/lesson and find the suitable teaching strategies. By suitable I want to emphasise active teaching strategies such as problem-based learning involving ill-structured problems, concept mapping, sharing and small groups, interactive notations system for effective reading and thinking, teacher modelling, scaffolding and feedback. Moreover, practitioners have to develop their own Critical Thinking skills as well as any theoretical knowledge about the concept of Critical Thinking to be able to conduct instructional interventions where Critical Thinking skills are developed.

Chapter 6: CONCLUSIONS

Critical Thinking development has been an ongoing topic for scholars and practitioners in the field of education. This is due to the difficulties in developing and aligning the teaching methods for covering both knowledge acquisition and critical skills development. This thesis focuses on providing an answer to the following research question: *How can Critical Thinking skills be measured and developed in a process that acknowledges both skills development and knowledge acquisition in educational contexts?* In answering the research question, four papers have been produced. Initially, the definition and approach to measurement of Critical Thinking skills are needed. For the purpose of this thesis, knowledge and insights from a triadic approach consisting of Philosophy-Psychology-Education have been compiled. In this thesis, Critical Thinking is seen as the set of cognitive skills that enables the decision making of individuals. The instrument presented in this thesis, the RCTT, covers five main skills that enable the thinking process: inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments. Secondly, once the definition and measurement of the concept are established and Critical Thinking skills can be assessed, an instructional intervention can be developed. The instructional intervention consists of a student-centred teaching method with constant engagement of the students as an active and decisive part of the learning process.

6.1. Research limitations

Limitations of the thesis are related to the measurement of Critical Thinking skills and the limitations of instructional interventions. In this thesis, Critical Thinking skills were measured only with the RCTT, which is an advantage for the validation of the instrument but a limitation for comparing the level of Critical Thinking skills from different perspectives. The limitations extend to the lack of considering Critical Thinking dispositions. While our focus was solely on the skills that can be trained through instructional interventions, it is acknowledged that Critical Thinking combines skills and the dispositions towards being a critical thinker. Furthermore, in the study presented in this thesis, only one experimenter conducted the quasi-experiment. This was preferred in order to consider one person's behaviour and only one voice throughout the study. Nonetheless, it might be a limitation due to the extent of the experimenter's inherent biases. Further studies would complement and perhaps extend the quasi-experiment findings. Not least, in the thesis only a limited selection of teaching methods were designed and tested in the instruction intervention. This was due to the specific focus on the literature in the Critical Thinking field. This is a limitation as the educational field has several other teaching methods that can be implemented in interventions that aim to develop Critical Thinking.

6.2. Future research directions

Future research can overcome the identified limitations imposed by the measurement and context of the instructional intervention. Specifically, future research should both develop and test the RCTT by extending the sample and comparing it with results from other tests. The RCTT can be compared to instruments with similar approaches to adaptation to other national or other cultural settings. Furthermore, instruments that measure both skills and disposition could be used for more comprehensively assessing Critical Thinking in the instructional intervention. The instructional intervention should be replicated with multiple examiners and extend to several groups of students. This would enable the assessment of the reliability and external validity of the intervention itself. And last but not least, more active teaching methods (e. g., methods that stimulate students' inquiry and openness to new perspectives, and involve them in thinking through the learning process) should be tested in experimental designs with new instructional interventions. This thesis paves the way for further research on the development of CT skills as an integrated part of the instructional interventions in educational contexts.

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