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REVIEW

Basic Thinking Skills and Their Direct Instructional Approaches: A Narrative Review

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Introduction: Basic thinking skills serve as fundamental cognitive operations that underpin all forms of thought, acting as catalysts to enhance the speed, efficiency, and quality of mental processes. These skills are prerequisite for developing higher-level abilities such as critical thinking, problem-solving and clinical reasoning, which are essential pillars of medical education. Addressing the existing gap in practical instructional methods, this narrative review aimed to define basic thinking skills and identify specific tools and approaches for their direct instruction.

Methods: A narrative review was conducted by searching authoritative databases. Keywords such as "basic thinking skills", "direct instruction", and their equivalents were utilized. From an initial pool of 4,697 records, following the removal of duplicates and a rigorous screening process, 56 sources (9 regarding the identification of skills and 47 regarding instructional methods) that were most relevant to the study objectives were selected and analyzed.

Results: Basic thinking skills align largely with frameworks such as Bloom's taxonomy (remembering, understanding, applying) and Marzano's dimensions. Identified direct instructional tools and methods were classified into three main categories: 1) Standalone programs independent of the formal curriculum (eg, CoRT, Philosophy for Children [P4C], and thinking schools); 2) Programs embedded within specific academic subjects (eg, the use of Six Thinking Hats or concept mapping in nursing and medical courses); and 3) Programs infused throughout the entire curriculum (eg, ACTS). Recent evidence (2020–2025) highlights the significant effectiveness of these tools in enhancing clinical reasoning and ethical decision-making in health professions education.

Conclusion: The findings demonstrate that direct instruction of basic thinking skills via structured tools efficiently fosters higher-order thinking. Versatile tools like concept maps and Six Thinking Hats adapt well to medical education. Educators and curriculum planners should adopt hybrid approaches for systematic integration into pre-clinical and clinical training, building foundations for professional competence and lifelong learning.

Keywords: thinking skills, instructional approaches, narrative review

Introduction

John Dewey defines thinking as "an active and continuous examination of beliefs based on evidence and reasons"[1] Building on this, Bloom[2] considers thinking as a conscious and active focus on a subject, analyzing and investigating it using logic and reasoning and obtaining logical and acceptable results and conclusions.

Experts have defined types of thinking as horizontal/vertical thinking, convergent/divergent thinking, critical thinking, creative thinking, and lateral thinking.[2,3] Regardless of these categories, the researchers of the American Curriculum Planning and Supervision Association, in their book Dimensions of Thinking: Framework for Curriculum and Instruction, have defined five dimensions for thinking used to analyze various teaching approaches. These dimensions include 1) basic thinking skills, 2) thinking processes, 3) creative and critical thinking, 4) metacognition, and 5) the relationship of content area knowledge to thinking.[4]

Basic thinking skills are fundamental cognitive operations necessary for analysis, comprehension, and problem-solving in varied contexts, including medical. These skills are fundamental cognitive operations utilized in various processes and types of thinking. For example, skills such as comparing and categorizing are often employed in decision-

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making and problem-solving.[4] Basic thinking skills can be likened to a catalyst in a chemical reaction; while they do not create the initial conditions or the final product, they significantly increase the speed of the reaction.[5] Since learning basic thinking skills is essential for developing critical and creative thinking, as well as metacognition and decision-making, understanding these skills and their teaching methods is crucial and should be considered the first step in teaching thinking.

After identifying the types of basic thinking skills, it is also important to determine the methods for teaching these skills. Two main approaches to teaching thinking are proposed: a) integrating topics related to teaching thinking into school lessons, and b) teaching thinking directly.[6–8] In the first approach, thinking skills are developed while teaching traditional school subjects. However, proponents of the second approach argue that thinking skills should be taught directly, suggesting that implicit teaching integrated with other lessons is insufficient. Consequently, a dedicated lesson on thinking skills should be included in the curriculum.[8] In teaching higher-order thinking skills (HOTS, such as analysis and evaluation, build upon lower-order skills like remembering and understanding), a hybrid approach—where a skill such as critical thinking is taught independently while also developing field-specific critical thinking—has been reported to be more effective than other methods.[9]

Various programs have been designed for the direct training of thinking skills. In 1990, Nisbet and Davies identified more than 30 types of thinking skills training programs.[10] Some of these programs are designed to develop discrete skills and processes such as categorization and ordering as a means of creating building blocks for thinking. Another type of thinking training program focuses on real-world and broader skills such as considering different perspectives, dealing with complex information, or creative problem-solving. Philosophy for Children and CoRT (Cognitive Research Trust) are examples of these programs.[11]

In schools worldwide, De Bono's Six Thinking Hats technique is widely used for teaching decision-making. For instance, Papakitsos et al[12] employed poetry, painting, and art to introduce the Six Hats to middle school students, who then applied the learned skills to solve real-life problems. For the post-simulation reflection phase in the emergency department, Zhang et al[13] used De Bono's Six Thinking Hats as a method to structure the debriefing conversations of medical assistants after the simulation event. The assistants who used the six-colored hats technique during the conversation were better able to stay in their respective thinking frames during the conversation compared to the participants who did not use this technique. Similarly, Mevlude et al[14] used the Six Hats model to teach critical thinking to surgical nursing students, showing that this technique can enhance problem-solving and reflective abilities in various contexts.

In an intervention study, Khabaz et al[15] taught 10 skills of CoRT Edward De Bono to a sample of 20 female students of Birjand University. The results show the significant impact of training on problem-solving skills and the subjective well-being of students. Ahmedbeigi et al[16] taught thinking skills to undergraduate accounting students of Azad University and demonstrated that teaching skills related to critical thinking significantly increase collaborative learning in students. Zare[17] taught the skills of analysis, interpretation, evaluation, inference, understanding, explanation, and self-management to undergraduate students of Payam Noor University in Tehran during 12 direct training sessions. This study showed that this training promoted self-directed learning and problem-solving in students.

Zulfiqari[18] taught cognitive and metacognitive strategies such as reading aloud, questioning, and reviewing as effective factors in activating the mind for critical thinking, during seven one-hour sessions, to the students of Payam Noor University in Hamedan. The results of this study showed the improvement of students' critical thinking skills.

The mentioned evidence shows the effectiveness of direct teaching of basic thinking skills to learners. However, a comprehensive and unified summary of specific direct teaching tools and methods for these fundamental skills, particularly within the context of health professions education (HPE), remains largely underexplored. While many tools and strategies for teaching thinking skills have originated in K-12 education, their applicability and limitations in the distinct, high-stakes environment of medical education require careful consideration. There is a clear need to synthesize existing knowledge on direct training approaches to equip educators with appropriate methods for fostering these foundational cognitive abilities in future health professionals.

This review aims to address this gap by systematically identifying basic thinking skills and the available tools and methods for their direct training. Specifically, this study seeks to answer the following research questions:

RQ1: What are the key basic thinking skills identified in the literature?

RQ2: What specific tools and direct training methods are available for teaching these basic thinking skills?

Method

This current narrative review study was conducted to identify basic thinking skills and their teaching methods from 2021 to 2023. The two research questions of this study were as follows: "What are the basic thinking skills?" and "What tools and methods have been used to teach basic thinking skills directly?" Searching for resources with keywords "Core Think* skill*", "General Think* skill*", "Basic Think* skill*", "Essential Think* skill*" Train*Pedagog*Teach*Educat*Techni*Method*Activit * and strategy* and their Farsi equivalents were done in various search engines and databases including SID, Google Scholar, Google, ERIC, ISI, PubMed, Scopus, Proquest, and Magiran without time limit. The search was done twice in each: to answer the first research question, only keywords related to basic thinking skills were used, and to answer the second research question, all keywords were used. It should be noted that the current research was focused on direct methods of teaching thinking, but in the search strategy, the directness of the method was not considered in order not to eliminate appropriate benefits. In the next step, the indirectness of the teaching method was considered as an exclusion criterion.

All studies and documents related to types of basic thinking skills and direct training courses and methods were included in the study, regardless of the methodology used. Studies or documents that dealt with specific types of thinking, such as critical thinking, creative thinking, design thinking, or systemic thinking, or did not directly contribute to developing thinking skills, were excluded from the study.

In the initial search, 1587 records were obtained for the first question and 3110 records for the second question (4697 records in total). In the next step, after studying the title of the records, 1549 records from the first question and 2837 records from the second question (4386 records in total), which were unrelated or duplicates, were deleted. Then, abstracts of articles and content of non-article records were studied for 38 records related to the first question and 273 records related to the second question. After studying the abstracts of the articles and checking the content of non-article documents, 255 records unrelated to the article were identified and discarded.

Finally, a detailed study of 9 sources for the first question and 58 sources for the second question, which were the most suitable for the title and purpose of the study, was conducted. In the detailed study of the articles and documents, it was intended to obtain the answers to the two research questions. In fact, by careful study, what was considered basic thinking skills in that source and the methods that were recommended or used for its direct training were extracted.

Ethical considerations: This research is a part of research project number 399880 and has the ethics code number IR.MUI.MED.REC.1399.981.

Results

In this review study, after examining 67 sources, basic thinking skills and their direct teaching methods were identified. In response to the question "What are the basic thinking skills?" based on 9 sources analyzed[19–27] several classifications for basic thinking skills were obtained (see Table 1). Although the answer to the research question is the types of basic thinking skills, the categories that considered the whole range of thinking skills, including both basic thinking skills and higher-level thinking skills, were also reported. These categories share much in common, and Marzano[5] believes that these lists should not be considered inviolable.

One of the classifications presented for basic thinking skills is Mishra and Kotecha's classification.[19] They have described thinking skills based on Bloom's taxonomy in two categories: higher-order thinking skills (analysis, evaluation, and generating) and lower-order thinking skills (remembering, understanding, and applying).

In response to the question "What tools and methods are used for direct training of basic thinking skills", the programs, methods, and tools found under the title of activities related to direct training of basic thinking skills, are in three categories:

1. The general thinking skills training programs are taught separately from the official curriculum and were placed in the following categories based on the nature of the program manager:

- Programs implemented in schools
- Programs are provided in institutions, systems, or virtual databases

Table 1 Summary of Classification of Thinking Skills (Answer to the Question "What are the Basic Thinking Skills?")

	Presented Categories of Thinking Skills	Study
1	Mishra & Kotecha (2016)[19]	1. Recalling 2. Understanding 3. Applying 4. Analyzing 5. Evaluating 6. creating
2	Swartz R (2012)[20]	1. Generating ideas ● Alternative possibilities Multiplicity of ideas varied ideas detailed ideas ● Composition Analogy/ metaphor 2 Clarifying ideas ● Analysis of ideas Compare/contrast Classification/Definition parts/whole sequencing ● Analyzing arguments Finding reasons/ conclusions uncovering assumptions 3 Assessing the reasonableness of ideas ● assessing basic information accuracy of observation Reliability of sources ● Inference Use of evidence Causal explanation Prediction Generalization reasoning by analogy Deduction Conditional reasoning (if ….then…) Categorical reasoning (some….all…) 4 Complex thinking tasks Decision making **Problem-solving**

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3	Heong Y M (2011)[21]	1. Comparing 2. Classifying 3. Inducing 4. Deducing 5. Analysis error 6. Constructing supporting 7. Analyzing perspectives 8. Abstracting 9. Decision making 10. Investigation 11. Problem-solving 12. Experimental inquiry 13. Invention
4	Armstrong T (2003)[22]	1. Observing 2. Generating ideas 3. Asking questions 4. Connecting 5. Making analogies 6. Recognizing matters 7. Solving problems 8. Transforming 9. synthesizing
5	Kagan (2003)[23]	Understanding information Recalling Summarizing Symbolizing Categorizing Role-taking Manipulating information Analyzing Applying Inducing Deducing Problem-solving Generating information Brainstorming Synthesizing Predicting Evaluating Questioning

(*Continued*)

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Table 1 (Continued).

	Presented Categories of Thinking Skills	Study
6	Wegerif R (2021)[24]	1. Information processing skills • Determine and collect relevant information • sorting • Classification • Create a sequence • Compare and contrast • Analysis of relationships between parts and the whole 2 Reasoning skills • Giving reasons for opinions and actions • Inference and inference • Use precise language to explain what he thinks • Judgment and informed decision with reasons and evidence 3 Research skills • Asking appropriate questions to determine and define the problem • Questions, to plan and define problems, to • Planning what to do and how to do the research • Anticipate results and consequences • Testing results and improving ideas 4 Creative thinking skills • Generating and expanding ideas • Suggest hypotheses • Use imagination • Looking for alternative novel results 5 Assessment skills • Information evaluation • Judging the value of what they read, hear, or do • Constructing criteria for judging the value of one's own or others' ideas and work 6 Having confidence in your judgment

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7	Barber M (2000)[25]	1. Information processing skills ● Get the right information ● Sorting, classifying, and organizing information ● Compare information ● Identification and analysis of existing communications 2 Reasoning skills ● Giving reasons for opinions and actions ● to infer ● infer ● Informed decision-making/judgment ● Use precise language to argue 3 Research skills ● asking questions ● Specifying research questions ● Research planning ● Prediction of results ● Anticipate consequences ● draw conclusions 4 Creativity ● Idea generation ● Development of ideas ● hypothesizing ● Use imagination ● Search for innovative options 5 Evaluation ● Development of evaluation criteria ● Applying evaluation criteria 6 Judging the value of information and ideas

(*Continued*)

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Table 1 (Continued).

	Presented Categories of Thinking Skills	Study
8	Perkins D & Swartz R (2000)[26]	1. Generating Ideas Alternative Possibilities Multiplicity of Ideas Varied Ideas New Ideas Detailed Ideas 2 Clarifying Ideas ● Analyzing Ideas Comparing/ Contrasting Classification/Definition ● Analyzing Arguments Finding Conclusions/Reasons Uncovering Assumptions 3 Assessing the Reasonableness of Ideas ● Support of Basic Information Determining Accurate Observation Reliability of Secondary Sources Determining Reliable Secondary Sources ● inference Use of evidence Causal Explanation Prediction generalization Reasoning by analogy Deduction ConditionalReasoning (If … then …) Categorical Reasoning (All/Some…)

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9	Marzano R J (1988)[27]	1. Focusing Skills • Defining g problems • Setting goals 2 Information Gathering Skills • Observing • Formulating questions 3 Remembering Skills • Encoding • Recalling 4 Organizing skills • Comparing • Classifying • Ordering • Representing 5 Analyzing Skills • Identifying attributes and components • Identifying relationships and patterns • Identifying main ideas • Identifying errors 6 Generating Skills • inferring • Predicting • Elaborating 7 Integrating Skills • Summarizing • Restructuring 8 Evaluating Skills • Establishing criteria • Verifying

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- Programs offered in thinking schools, thinking clubs
- Programs that are offered in free training courses
- Programs offered in universities

2. Programs that are taught as part of a subject in the curriculum of schools or universities

3. Programs that are infused throughout the curriculum in schools or universities

The types of thinking training programs, the nature of the implementation of the programs, and the number of documents obtained for each case are given in Table 2.

Tables 3–9 present the themes and sub-themes of the reviewed articles and documents.

Table 2 Types of Direct Training Programs for Basic Thinking Skills

Programs	Number of Documents	The Nature of the Program Manager
Programs separate from the formal curriculum	Official schools	10
	Institutions, systems, or virtual databases	10
	Thinking schools, thinking clubs	1
	Free training courses	2
	Universities	7
Programs that were part of a subject or lesson in the curriculum	Schools and universities	20
Programs infused throughout the curriculum	Schools and universities	6

Table 3 Resources Related to Teaching General Thinking Skills in Schools Separately from the Curriculum

	Study	Place	Teaching Method	Content	Content	Study Design	Strength of Evidence
1	Doğan Dolapçıoğlu, S (2021)[28]	Türkiye	Direct teaching	CoRT 5	Primary Year 5 students	Case study	Low
2	Maniam, M (2020)[29]	Malaysia	Direct teaching	CoRT 1	Primary Year 6 students	Pre-test and post-test interview	Moderate
3	El-sherbety (2019)[30]	Nabaroo	Direct teaching	CoRT 4	First year of high school	semi-experimental	Moderate
4	Yeoh Sun W (2018)[31]	Malaysia	Direct training	Thinking Maps, 6 Thinking Hats, Bloom's Taxonomy	Native students	Quasi -experimental	Moderate
5	Daher W (2017)[32]	Israel	Direct teaching	CoRT 4	Primary Year 6 students	Semi-experimental study	Moderate
6	Al-Edwan M (2011)[33]	Jordan	Direct teaching	CoRT	Primary Year 7 students s	Experimental study	Moderate
7	Kim C H (2013)[34]	Busan	Direct training	A selection of CoRT lessons	Young children in kindergartens	Semi-experimental	Moderate
8	Naderi E (2012)[35]	Tehran	Direct training	Philosophy for children (P4C)	Preschool children	Semi-experimental	Moderate
9	Marashi S M (2010)[36]	Ahvaz	Direct training	Philosophy for children	Primary Year 5 students	Experimental research	Moderate
10	Naji S (2007)[37]	Tehran	Direct training	Philosophy for children (P4C)	Primary Year 4 students	Qualitative study	Low

Table 4 Courses, Institutes, Systems, or Virtual Bases for Teaching General Thinking Skills Separately from the Curriculum

	The Title of the Course, Institution, System, or Virtual Database	Content of Education	Description	Target Group
1	The Thinking Schools Academy Trust (TSAT)*	1. CoRT thinking tools 2. Developing mindset 3. Mind strength 4. Habits of mind 5. Philosophy for children 6. Thinking hats 7. Thinking Keys 8. Thinking maps	Students on the TSAT are supported to think clearly and monitor their progress through the Development and thorough understanding of thinking tools. Preparing teachers to teach thinking is one of the approaches of these schools.	Students and teachers
2	Thinking foundation**	1. Visual Tools for Cognitive/Critical Thinking Development: View Points Model 2. Dispositions for Mindfulness: Open Minds Model 3. Inquiry, Questioning, and Problem Solving: Reflective Action Process (RAP)	The Thinking Foundation, in collaboration with Thinking Schools International, organizes a workshop-interactive course for teachers and administrators of a series of pilot schools to improve thinking education.	Teachers
3	Thinking school's international***	1. Habits of Mind for Dispositions 2. Visual Tools for Critical Thinking 3. Questioning for Inquiry	This institution provides services to teachers, schools, and educational systems all over the world. It was founded in 2010 with the participation of the "Designs for Thinking in the US" group in the United States and the "Kestrel Education" group from England. T TSI implements three student-Centered models in schools around the world. The goals of the educational programs of this institution mainly revolve around the education of the students' thinking process, their thinking tendencies, and their problem-solving skills.	Teachers
4	Thinking matters****	1. Support leadership teams to implement their metacognitive initiatives 2. Work with teachers and professors to integrate metacognitive strategies into their teaching 3. Providing a range of metacognitive tools designed to support reflective learners	Thinking Matters is actually an educational consultancy that works with single schools, school groups, or government authorities to help them develop Meta learners (metacognitive, self-regulating learners) throughout their organization. This institute helps schools around the world to become a school of thought. While it has developed a model that supports schools that want to become schools of thought, it also offers tailored training and access to specific tools depending on the individual needs of the school.	Schools

(*Continued*)

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Table 4 (Continued).

	The Title of the Course, Institution, System, or Virtual Database	Content of Education	Description	Target Group
5	De Bono Website*****	1. Lateral thinking • Alternatives • Focus • Challenge • Random entry • Provocation & Movement • harvesting • Treatment of Ideas 1. Six thinking hats 2. Series of CoRT lessons: • CoRT 1: breadth • CoRT 2: Organization • CoRT 3 interaction • CoRT 4 Creativity • CoRT 5 information and feelings • CoRT 6 actions 1. Simplicity tools • Removal • Historical review • combine • Shift & Delegate • challenge • Value Shedding • Replacement • Wishful Thinking • Provocative Amputation • Bulk & Exception • Modules & Small Units • Restructuring Re-arrange - Existing Parts • Broad & Narrow View • General flavor • Start Afresh • - ladder	De Bono is an organization created to develop, promote, license, and protect the work of Dr. Edward de Bono in the teaching of thinking. According to many, Dr. de Bono is known as the main authority on Generalized thinking and teaching thinking as a skill. Its purpose is to use thinking as an everyday skill.	All people
6	University of South Australia: Tools for Thinking******	Y Figures PMI Figures De Bono's Six Thinking Hats 3–2-1 Thinking Brainstorming	The University of South Australia has tried to encourage learners to participate and think about their learning by providing tools. They have tried to provide patterns, instructions, rationales, and examples of how to use them.	Students
7	Future Learn: Thinking Tools for the Classroom*******	T chart Venn diagram Story map	Future Learn is a virtual skills training platform that teaches skills in collaboration with universities and experts worldwide. In this platform, a collection of graphic organizers and thinking tools are presented to help learners participate in their learning.	Different learners

8	ITC think drive: thinking tools********	Analysis: SWOT Analysis Icon Prompt PCQ / PCQ Extension argue: PCQ / PCQ Extension Judge Jury calculate: Solution Path classify: Fishbone Diagram Flow Chart Silent Card Shuffle compare: Double Bubble Map Contrast: T-Chart create: MAS 1:4:P:C: R Image Associated Ideas Word Association Split Y-Chart / Y – Chart Describe: describe Attribute Listing Organizer Concept Map Y-Chart / Split Y-Chart discussion: PCQ PCQ Extension evaluate: Elimination Draw Extent Barometer	Think Drive is a digital resource database developed by ITC Publishing that enables learners to become independent learners with thousands of downloadable resources. Founded in 2002, ITC publications have drawn on the contributions of hundreds of educational writers, educational consultants, university lecturers, and teachers to create these valuable digital resources.	Different learners
9	Untools: Tools for Better Thinking*********	Minto pyramid/Situation-Behavior-Impact/ Concept map/ Ishikawa diagram/Cynefin framework/ Conflict Resolution Diagram/ Six Thinking Hats/ Productive Thinking Mode/ Connection circles/ Second-order thinking/ Iceberg Model/ Eisenhower Matrix/ Ladder of inference/ Abstraction laddering/ Decision matrix/ Inversion/ Issue trees/ Confidence determines speed vs quality/ First principles/ Balancing feedback loop/ Reinforcing feedback loop/ Hard choice model.	Untools is a website that tries to collect thinking tools that are scattered all over the web and present them as a set of tools and frameworks for purposeful improvement of thinking.	Different learners

(*Continued*)

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Table 4 (Continued).

	The Title of the Course, Institution, System, or Virtual Database	Content of Education	Description	Target Group
10	The learning curve: Thinking tools*********	Answer, Reflect, Share/ CAP Consider All Possibilities/ Claim, Question, Support, Decision/ Colors, Symbols, Pictures, Animals/ Connect, Extend, Challenge/Creative Ripples/Define, describe, example, opposite/ Describe, Oppose, Analyze, Troubleshoot/Describe, Trends, Risks, Predictions/Discover, conclude, generalize, assess/Event, Cause, Effect / Exploring Habits of Mind/ Fact or Fiction/Fish Thinking/Five Es of Learning/Give and take/Glad, Mad, Sad/Golf Thinking/ Ideas, Question, Bridge/ Ideas Figure/ Intersections. Interview Panel/ Issues Matrix/ Know, What, How, Learn/ Learning Jigsaw/ Like, Dislike, Undecided/ Look, Think, Wonder/ Mottoes/ Musts and Options/ Newspaper Headlines/ Observe, Issues, Problems/ Outlooks ParaFigure Building TEEL/ Plan, Do, Reflect/ Points of the Compass/ Positives, Negatives, Effects, Decisions/ Problems, Issues, Options, Effects, Solutions/ Pros, Cons, Issues/ Question Explosion/ Question Storms/ Real, Perceive, Care/ Relate, Question, Explore/ Sameness and Difference/ Seven Strengths Thinking/ State, Describe, Justify/ Strengths, Weaknesses, Opportunities, Threats/ T-Figure/ The Hand/ The Tree/ Think, Pair, Share/ Three Amigos/ Three Joys/ Time Machine/ Time Understandings/ True, False, If/ Truth Traffic Lights/ Unfair, Fairer, The Future/ Urgency vs Importance/ What, why, what/ Where Do You Stand/ Who What Where When Why How/ X-Diagram/ Y-Diagram	The learning curve is a database that offers a wide range of products and resources for elementary and secondary students and teachers. Learning Curve products and resources are available in print and online to suit the needs of different schools.	Students and teachers

Notes: *https://www.tsatrust.org.uk. **https://www.thinkingfoundation.org/. ***https://www.thinkingschoolsinternational.com/. ****https://www.thinkingmatters.com. *****https://www.debono.com/. ******https://lo.unisa.edu.au/mod/book/view.php?id=610988andchapterid=115177. *******https://www.futurelearn.com/info/courses/study-melbourne/0/steps/265770. ******** https://itcthinkdrive.com.au/thinking-tools. *********https://untools.com. **********https://learningcurve.com.au/activity-type/thinking-tools.

Table 5 Resources Related to Teaching Basic Thinking Skills in Thinking Clubs Separately from the Curriculum

	Title of School or Club	Educational Content	Description
1	UCT thinking club*	• Maximize lateral thinking • Generate alternative solutions • Work as a team using the six thinking hats • Consider all the consequences and make better decisions • Avoid common social biases such as fundamental documentation errors (ie do not judge a book by its cover!)	The mission of this club is to create a space for ideas and creativity to flourish and to teach skills to help learners think laterally. Based on the ideas of Dr. Edward de Bono, they introduced a new system of collaborative, creative, and lateral thinking. This club is where ego and emotions are separated from the discussion process. They want to overcome the dogmas and patterns that often dominate our thinking and teach us how to be more creative, open-minded, and tolerant. It is a free-thinking club where different classes are present. Their goal is to make people think: about entrepreneurship, philosophy, design, and culture. This club is made up of thinkers outside the university who come together and discuss interesting ideas using the tools and frameworks designed by de Bono. These creative and engaging sessions help members learn tools that make them better lateral thinkers.

Notes: *https://miguel-p.github.io/ThinkingClub/index.html.

Table 6 Resources Related to Teaching Basic Thinking Skills in the Form of Free Training Courses and Separate from the Curriculum

	Title of the Course	Educational Content	Description
2	Philosophy for children (p4c)38	a. Stimulate the conversation b. Ask questions and decide on the topic under discussion c. Have a conversation d. Participate in the conversation e. Justify f. Ask questions g. Define the main concept and look for criteria	Philosophy for Children (P4C) is an educational method where children engage in philosophical inquiry to enhance thinking, communication skills, self-confidence, self-esteem, behavior, and well-being. Adopted in over 150 countries, it focuses on fostering deep reasoning in youth rather than rote learning or traditional philosophy. Instead, students actively explore questions through research and form inquiry communities to develop critical thinking.
2	Tizfekri*	a. Clear thinking b. Critical questioning c. Critical reasoning d. Prescriptive writing e. Good job baby f. Child and Adolescent Thinking School	Tiz Fekri is a cultural and artistic institute that was founded in Isfahan by Dr. Hamed Safaipour in 2019 with the aim of developing and teaching thinking skills. The target group of this institution is all sections of society and its motto is "Be bold, think".

Notes: *https://tizfekri.com.

Discussion

This narrative review synthesizes the literature on basic thinking skills—fundamental cognitive operations such as recalling, understanding, applying, analyzing, evaluating, and creating, as framed by Bloom's taxonomy[19] and the direct instructional approaches for their development. The findings highlight a diverse array of tools and programs, categorized into standalone programs (eg, CoRT, Philosophy for Children), subject-embedded methods (eg, Six Thinking Hats in specific courses), and curriculum-infused strategies (eg, ACTS, i-Think). These approaches align with the dimensions of thinking outlined by Marzano,[4] emphasizing their role as catalysts for higher-order thinking skills (HOTS) like critical thinking and problem-solving in educational contexts. While much of the evidence originates from K-12 settings, emerging applications in health professions education (HPE) demonstrate potential for fostering clinical reasoning and

Table 7 Resources Related to Teaching Basic Thinking Skills in Universities Separately from the Curriculum

	Study	Training Place	Educational Content	Teaching Method	Target Group	Description	Strength of Evidence
1	Demissie, F. et al (2025)[38]	UK	P4C	Direct training	First year students of teacher education department of an English university	Qualitative research	Low
2	Ibrahim Morsy A (2021)[39]	Egypt	Six Hats Thinking Technique	Direct training	Nursing students	Quasi-experimental	Moderate
3	Israel S (2019)[40]	USA	Concept map	Direct training	Physician Assistant (PA) students	Experimental research	Moderate
4	Alshurman W M (2017)[41]	Jordan	CoRT1	Direct training	Students from different specializations and academic levels	Pre-experimental design	Low
5	Khabaz H (2016)[15]	Birjand, Iran	CoRT	Direct training	Female students of different disciplines	Pre-experimental design	Low
6	D'Antoni A V (2010)[42]	America	Mind map	Direct training	First-year medical students	Semi-experimental research	Moderate
7	Al-Jallad M (2006)[43]	Emirates	CoRT	Direct training	Students of Arabic language and Islamic studies	Pre-experimental design	Low

professional competence. The review extends prior frameworks by integrating recent studies, particularly those from 2020 to 2025, to address the evolving demands of medical education amid complexities like multimorbidity and interdisciplinary care.

Strength of Evidence

The quality and relevance of studies vary across tools, with assessments based on design rigor (eg, randomized controlled trials [RCTs] as high, quasi-experimental as moderate, descriptive or expert opinion as low) and applicability to HPE. For the CoRT program, evidence is moderate, primarily from quasi-experimental studies in K-12 (eg, Doğan Dolapçıoğlu & Doğanay, 2021;[28] Maniam et al 2020[29]) showing improvements in creativity and problem-solving, but limited HPE-specific RCTs; recent applications in higher education (eg, Mousa, 2022[53]) suggest moderate relevance for university-level critical thinking, though generalizability to clinical settings is low due to small samples. Philosophy for Children (P4C) has moderate evidence from mixed-methods and experimental designs in K-12 (eg, Ventista & Maria, 2019;[69] Naderi et al, 2012[35]), enhancing reasoning and moral judgment, with emerging low-to-moderate relevance in higher education (eg, using P4C for discussion facilitation; Demissie et al, 2025[38]), but scant HPE-specific data limits its strength in medical contexts.

Six Thinking Hats demonstrates high evidence, supported by RCTs and quasi-experimental studies in both K-12 and HPE (eg, Ibrahim & Darweesh, 2021;[39] Alshurman, 2017[41]), with recent 2025 studies in nursing confirming significant gains in critical thinking and skills retention (eg, Elbilgahy et al, 2025;[48] Soylu et al, 2025[45]). Concept mapping also has high evidence from systematic reviews and RCTs (eg, Aein & Aliakbari, 2017;[57] Bixler et al, 2015[60]), with 2020–2025 meta-analyses in nursing and medical education showing robust improvements in critical thinking (eg, Faraji et al, 2025;[70] Fonseca et al, 2024[49]). Infused programs like ACTS and i-Think have moderate evidence from longitudinal and scoping reviews in K-12 (eg, Hamzah & Wan Yusoff, 2021;[64] McGuinness, 2000[67]), but low relevance to HPE due to minimal adaptation studies. Overall, HPE-focused evidence is stronger for tools like Six Thinking Hats and concept mapping, with calls for more RCTs to address publication bias and heterogeneity.

Table 8 Resources Related to Teaching Basic Thinking Skills Integrated in One or Several Lessons

	Study	Training Place	Content of Education	Teaching Method	Target Group	Description	Strength of Evidence
1	Das R(2025)[44]	India	Integrating Problem-Based Learning (PBL) with Six Thinking Hats	Direct training during Oral Pathology course	Oral Pathology residents	Quasi-experimental research design	Moderate
2	Soylu A et al (2025)[45]	Turkey	Six thinking hats	Direct training during insulin administration skills	Nursing students	A mixed-methods study	Low
3	Sethi S et al (2025)[46]	Saudi Arabia	Six thinking hats	Direct training during biomedical ethics	Nursing students	Descriptive study	Low
4	Mayer A et al (2025)[47]	-	Concept map	Direct training during Virtual Patient–Based Clinical Reasoning Education	Medical students	Mixed Methods Study	Low
5	Elbilgahy, A. A. et al (2025)[48]	Egypt	Six Thinking Hats	Direct training during life span course	Nursing students	Quasi-experimental research design	Moderate
6	Fonseca, M (2024)[49]	Portugal	Concept map	Direct training during clinical reasoning in multimorbidity	Undergraduate family medicine students	A mixed methods study	Low
7	Vedawala NP (2024)[50]	India	Six Thinking Hats	Direct training during physiotherapy course	Undergraduate physiotherapy students	Pre-experimental pilot study research	Low
8	Turkestani F A (2024)[51]	Ascending Arabia	Mind map	Direct training during respiratory training therapy	Medical school students	Quasi-experimental design	Moderate
9	Sannathimmappa, M. B(2022)[52]	India	Concept map	Direct training during immunology course	Third-year undergraduate (MD3) medical students	Descriptive study	Low
10	Mousa O (2022)[53]	Iraq	CoRT	Direct training during English language course	English language learners	Experimental study	Moderate
11	Phuntsho U (2020)[54]	Bhutan	Six Thinking Hats	Direct teaching during English lessons	Seventh-grade English language students	Quasi-experimental research design	Moderate
12	Silva Ezequiel O D(2019)[55]	Brazil	Concept map	Direct training in the first week of the internship rotation	Medical students	Pre-experimental design	Low
13	Salih O A (2019)[56]	Iraq	CoRT1	Direct training During the English lesson	English language students	Quasi-experimental research design	Moderate
14	Aein F (2017)[57]	Iran	Concept map	Direct training during nursing care	Master students in pediatric clinical nursing	Experimental design	Moderate
15	Ziadat A (2016)[58]	Jordan	Six Thinking Hats	Direct training during the Arabic training course	Bright students of seventh grade	Pre-experimental design	Low
16	Hmeadat S R (2016)[59]	Jordan	CoRT 1 CoRT 4	Direct training of CoRT and its applications in learning English and discussing the program	Seventh-grade students	Experimental design	Moderate
17	Bixler G M (2015)[60]	America	Collaborative Concept Mapping	Direct teaching during the infant lesson	Fourth-year medical students	Pre-experimental design	Low

(*Continued*)

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Table 8 (Continued).

	Study	Training Place	Content of Education	Teaching Method	Target Group	Description	Strength of Evidence
18	Rule A C (2012)[61]	America	CoRT1	Direct training during the flood training course	Students of different ages from pre-kindergarten to eighth grade	Pre-experimental design	Low
19	Van der Schee J (2006)[62]	Netherlands	Taboo Odd One Out Maps from Memory Concept Maps Classification Mystery Fact or Opinion	Direct teaching during the geography lesson	First high school	Experimental study of pre-test and post-test	Moderate
20	Rule A (2008)[63]	Western United States	CoRT1	Direct training during bird habitat training	Third grade	Pre-experimental design	Low

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Table 9 Resources Related to Teaching Basic Thinking Skills Infused Throughout the Curriculum

	Study/Course	Training Place	Educational Content	Teaching Method	Target Group	Description	Strength of Evidence
1	Hamzah L M (2021)[64]	Malaysia	I-think map	Direct training	Elementary and middle school students	Scoping Review	Low
2	McCormack L (2014)[65]	Ireland	CASE (Cognitive Acceleration through Science Education)	Direct training	Elementary to middle school students	Quasi-experimental	Moderate
3	Dewey JL (2006)[66]	USA	ACTS	Direct training	Primary Year 4 and 5 students	Quasi-experimental	Moderate
4	McGuinness C (2000)[67]	Northern Ireland	ACTS	Direct training	Primary school students	Descriptive study	Low
5	Barak M (1999)[68]	Israel	Cort1-CoRT 6	Direct training	Students of different levels of high school	Quasi-experimental	Moderate
6	Kansal University Elementary School	Japan	Comparison: Venn diagram Categorization: X-Chart Association: Concept Map Analysis: Fish Bone Chart Synthesis: Pyramid Graph Evaluation: PMI sheet	Direct training	Primary Year 1 to 6 students	-	-

Notes: https://www.kansai-u.ac.jp/elementary/english/education/thinking/index.html.

Table 10 Evidence Map Table Summarizing Tools, Contexts and Outcomes, Along with Study Quality Indicators

Tool/ Method	Context (K-12/ HPE)	Targeted Basic Skills	Pedagogical Impact Mechanisms	Key Outcomes	Study Quality (Illustrative) *	Implementation Guidance (HPE)
CoRT Program	Primarily K-12; emerging in HPE (eg, nursing)	Generating ideas, multiple perspectives, evaluating options	Directed attention via tools like PMI/CAF; structured practice for systematic exploration	Improved problem-solving, subjective well-being; enhanced diagnostic reasoning	Moderate (quasi-experimental studies; limited recent HPE RCTs)	Pre-clinical: Standalone workshops with case scenarios; Clinical: Integrate in rounds with stepwise tool application and reflection
Philosophy for Children (P4C)	K-12; adaptations in higher ed/HPE	Reasoning, questioning, concept formation, critical evaluation	Collaborative inquiry, Socratic questioning; articulation and justification of ideas	Enhanced metacognition, communication; improved speaking and moral judgment	Moderate (meta-analyses, mixed-methods in higher ed)	Pre-clinical: Facilitated discussions on ethical cases; Clinical: Group debriefs post-simulation, with facilitator guiding inquiry
Six Thinking Hats	K-12 and HPE (nursing, medical, pharmacy)	Balanced analysis, creativity, emotional awareness, process control	Parallel thinking via role assignment; reduces bias, promotes comprehensive issue exploration	Enhanced critical thinking, problem-solving; better debriefing in simulations	High (RCTs and quasi-experimental)	Pre-clinical: Group ethical dilemma sessions; Clinical: Team-based patient management, assigning hats per round

(*Continued*)

Table 10 (Continued).

Tool/ Method	Context (K-12/ HPE)	Targeted Basic Skills	Pedagogical Impact Mechanisms	Key Outcomes	Study Quality (Illustrative) *	Implementation Guidance (HPE)
Concept Mapping	K-12 and HPE (medical, nursing)	Organizing information, identifying connections, understanding structures	Externalization of mental models; visual synthesis and gap identification	Improved critical thinking, knowledge retention; better clinical decision-making	High (systematic reviews, RCTs)	Pre-clinical: Map disease processes in lectures; Clinical: Patient care plans with peer review and revision
ACTS/ i-Think Programs	Primarily K-12; potential HPE infusion	Analysis, synthesis, evaluation	Sustained integration across curriculum; teacher training for consistent reinforcement	Flexible thinking, higher-order skills; strategic problem-solving	Moderate (scoping reviews, mixed-methods)	Curriculum-wide: Faculty training, pilot integration in simulations; evaluate via student outcomes

Notes: *Scale for study quality: High (RCTs, systematic reviews); Moderate (well-designed quasi-experimental/cohort studies); Low (pre-experimental, expert opinions, anecdotal evidence).

Integration of Recent Literature in Health Professions Education

While the review's core sources emphasize K-12 applications, recent literature (2020–2025) shifts focus to HPE, balancing the emphasis. For instance, in nursing education, Elbilgahy et al (2025) used Six Thinking Hats in a quasi-experimental design with 160 students, yielding significant critical thinking improvements ($p<0.001$) via structured case analysis.[48] Similarly, Soylu et al (2025) found it superior to video or traditional methods for insulin administration skills in an RCT (n=90), with median scores rising from 6.50 to 23.00.[45] In medical education, Sethi et al (2025) applied Six Thinking Hats in bioethics, simplifying decision-making for undergraduates through role-based thinking.[46] For concept mapping, Faraji et al (2025) meta-analyzed 44 studies (2005–2022), reporting a standardized mean difference of 1.693 ($p<0.001$) in performance[70] and Fonseca et al (2024) showed enhanced clinical reasoning in multimorbidity.[49] Collaborative concept maps in virtual patient scenarios (Mayer et al, 2025) fostered interdisciplinary clinical reasoning, though student preferences varied on scope and presentation.[47] These studies underscore adaptations for HPE, such as integrating tools into simulations or ethics modules, to address gaps in traditional curricula.

Mechanisms of Pedagogical Impact and Conditions for Effectiveness

Each tool strengthens specific basic thinking skills through distinct mechanisms, rooted in cognitive theories like constructivism[1] and metacognition.[71] CoRT directs attention via tools (eg, PMI for positives/minus/interesting), enhancing generating and clarifying ideas by breaking down complexity; it is most effective in small groups with facilitator guidance, particularly for problem-solving in low-stakes environments.[15] P4C promotes inquiry through Socratic dialogue, building reasoning and evaluation by encouraging justification and concept definition; effectiveness peaks in collaborative settings with diverse participants, though it requires trained facilitators to avoid superficial discussions.[69]

Six Thinking Hats fosters balanced analysis by assigning modes (eg, black hat for risks), reducing bias and promoting comprehensive exploration; mechanisms include parallel thinking for creativity and emotional awareness, most effective in team-based clinical simulations where time constraints mimic real-world decisions.[45,48] Concept mapping externalizes mental models hierarchically, aiding organization and inference by visualizing connections; it strengthens analysis and synthesis, performing best when integrated with feedback in clinical rotations, especially for novices.[47,70] Infused programs like ACTS embed skills across curricula via sustained practice, reinforcing metacognition through reflection; effectiveness depends on teacher training and curriculum-wide adoption, ideal for longitudinal HPE programs.[67] Conditions for optimal impact include learner readiness (eg, prior basic knowledge), group size (<10 for interaction),

and integration with domain-specific content; challenges like time demands or resistance are mitigated by hybrid approaches.[8]

The evidences map, which summarizes the tools, contexts, and results along with study quality indicators, is shown in Table 10.

Practical Contributions and Implementation Guidance

To enhance utility in HPE, the identified tools can be linked to stepwise implementation. In pre-clinical settings: (1) Assess learner baseline skills via pre-tests; (2) Introduce tools through workshops (eg, CoRT for idea generation in lectures); (3) Apply in small groups with case studies; (4) Provide feedback and reflection prompts; (5) Evaluate via post-tests. In clinical settings: (1) Integrate into rotations (eg, Six Thinking Hats in team huddles); (2) Use simulations for practice; (3) Facilitate debriefs focusing on skill application; (4) Monitor transfer to patient care; (5) Adjust based on outcomes. This bridges theory to practice, aligning with calls for hybrid approaches.[9]

Conclusion

This review identifies key basic thinking skills (eg, recalling, understanding, applying) and direct teaching methods (eg, CoRT, Six Thinking Hats, concept mapping), demonstrating their efficacy in fostering HOTS through structured, collaborative approaches. In HPE, these tools enhance clinical reasoning, problem-solving, and self-directed learning, with recent evidence (2020–2025) confirming superior outcomes in nursing and medical contexts compared to traditional methods.

Practical implications for medical educators include ready-to-use tools: (1) Six Thinking Hats for ethics workshops (assign hats to analyze cases); (2) Concept mapping for care planning modules (students map patient scenarios, with peer review); (3) CoRT for problem-solving sessions (use PMI in group discussions); (4) P4C for debriefs (facilitate inquiry on moral dilemmas). These can be scaled via online platforms for hybrid learning.

Limitations include the narrative review design, lacking formal quality appraisal (eg, no AMSTAR-2 scoring), potential publication bias toward positive results, and language bias (English/Persian sources dominant). Search strategies may have missed gray literature.

A research agenda proposes: (1) RCTs comparing tools in diverse HPE settings (eg, pre-clinical vs clinical); (2) Longitudinal studies assessing long-term retention and patient outcomes; (3) Investigations into digital adaptations (eg, AI-assisted mapping). These steps will refine evidence for impactful HPE curricula.

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