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# Metacognition in Action

Insights into Learning, AI, and Self-Regulation

*Edited by Murat Tezer*





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# Metacognition in Action - Insights into Learning, AI, and Self-Regulation

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Metacognition in Action – Insights into Learning, AI, and Self-Regulation

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Edited by Murat Tezer

#### Contributors

Hoedeok Gu, Kouider Mokhtari, Maria Cristina Antonucci, Mihwa Han, Murat Tezer, Nirmal Ghimire, Patricia A. Jennings, Renate Kosuch

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# Education and Human Development

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## Aims and Scope of the Series

Education and Human Development is an interdisciplinary research area that aims to shed light on topics related to both learning and development. This Series is intended for researchers, practitioners, and students who are interested in understanding more about these fields and their applications.



# Meet the Series Editor



Katherine Meltzoff received her BA in Psychology from Trinity College, in Connecticut, USA and her Ph.D. in Experimental Psychology from the University of California, San Diego. She completed her postdoctoral work at the Yale Child Study Center with Dr. James McPartland. Dr. Meltzoff's doctoral dissertation explored neural correlates of reward anticipation to social versus nonsocial stimuli in children with and without autism spectrum disorders (ASD). She has been a faculty member at the University of California, Riverside in the School of Education since 2016. Her research focuses on translational studies to explore the reward system in ASD, as well as how anxiety contributes to social challenges in ASD. She also investigates how behavioral interventions affect neural activity, behavior, and school performance in children with ASD. She is also involved in the diagnosis of children with ASD and is a licensed clinical psychologist in California. She is the Assistant Director of the SEARCH Center at UCR and is a faculty member in the Graduate Program in Neuroscience.



# Meet the Volume Editor



Murat Tezer was born in Nicosia in 1972. He earned a Ph.D. degree in Applied Mathematics and Computer Science at Eastern Mediterranean University in 2003. He worked as a project advisor at many schools under the grant program supported by the European Union. More than 100 of his research publications and books/chapters on mathematics education have been published and cited in numerous international journals. He directed more than 40 master's/doctoral theses as an advisor. He worked as the vice head of Computer Education and Instructional Technology. In 2008, he served as the head of the Department of Elementary and Secondary Mathematics Education from 2009 to 2018. He worked as Vice-Dean of the Education Faculty of Near East University between 2013 and 2018, and then he became a Professor of Mathematics Education. In addition, he is an executive board member of the Cyprus Educational Sciences Association.



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# Preface

Metacognition, the awareness and regulation of one's own thinking, has emerged as a central concept in contemporary educational research, cognitive science, and digital learning environments. As artificial intelligence (AI) technologies increasingly shape how individuals learn, interact, and make decisions, the need to understand and foster metacognitive processes becomes more urgent and multidimensional.

This edited volume, *Metacognition in Action - Insights into Learning, AI, and Self-Regulation*, brings together a diverse set of scholarly contributions that examine metacognition from both theoretical and applied perspectives. It presents a multidisciplinary exploration across educational, technological, and psychological domains, highlighting how reflective strategies can be harnessed to enhance both learning and well-being. The book is organized into two thematic sections, each offering distinct yet interconnected perspectives on the transformative potential of metacognitive practices.

## Section 1: **Metacognition in Learning and AI**

*Chapter 1: Metacognitive Engagement in AI-Supported Learning: Frameworks, Challenges, and Transformations.* This chapter introduces a conceptual framework for integrating metacognition into AI-enhanced educational environments. It emphasizes digital pedagogy, ethical educational technologies, and self-regulated learning as foundational elements for future-ready instruction.

*Chapter 2: Perspective Chapter: Beyond AI Optimization – The Epistemic and Normative Primacy of Metacognition in Data-Driven Lobbying.* This chapter explores how metacognitive reasoning informs advocacy and public affairs in AI-mediated decision-making. It highlights the epistemic and normative dimensions of lobbying in the context of artificial intelligence.

*Chapter 3: Thinking with Machines: Leveraging Artificial Intelligence (AI) to Foster Metacognitive Reading Comprehension.* This chapter examines how AI tools, including large language models, can act as metacognitive partners in literacy education. It offers insights into how technology can support students in monitoring and regulating their own understanding.

## Section 2: **Metacognition for Mental Well-Being and Self-Regulation**

*Chapter 4: Perspective Chapter: Metacognitive Insight and the Serenity Barometer – Calm Vs. Imperative Mental Processing.* This chapter introduces a self-reflection tool designed to foster serenity and mental self-regulation. Drawing on coaching and introversion techniques, it explores how metacognitive knowledge can support emotional balance.

Chapter 5: *Perspective Chapter: Mindful Metacognition – A Twenty-First Century Biohack for Adaptive Well-Being and Collective Flourishing*. Here, the intersection of mindfulness and metacognitive practice is examined as a pathway to stress reduction, resilience, and enhanced health span. The chapter positions metacognition as a tool for adaptive well-being.

Chapter 6: *Toward Metacognitive Balance: A Framework for Cognitive and Social Functioning in Schizophrenia*. Concluding the volume, this chapter presents a clinical framework for understanding how metacognitive balance can support cognitive and social functioning in individuals with schizophrenia, offering therapeutic insights grounded in reflective awareness.

Together, these chapters offer a rich and interdisciplinary perspective on metacognition in action. The volume is intended for educators, researchers, clinicians, and technologists seeking to deepen their understanding of reflective thinking and its transformative potential across domains.

I extend my sincere gratitude to all contributing authors for their thoughtful scholarship and collaboration. Special thanks to the editorial assistants and reviewers whose insights and support were instrumental throughout the development of this volume.

**Dr. Murat Tezer**  
Professor,  
Primary Mathematics Education Department,  
Near East University,  
Nicosia, Northern Cyprus

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Section 1

# Metacognition in Learning and AI

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# Metacognitive Engagement in AI-Supported Learning: Frameworks, Challenges, and Transformations

*Murat Tezer*

## Abstract

Metacognitive skills, which enable individuals to manage their own learning, can be integrated into artificial intelligence (AI)-supported educational environments. The complexity and rapid change brought about by the information age necessitate that learners not only acquire knowledge but also understand how they manage their learning. In line with this need, the study explores the multifaceted interaction between metacognitive learning strategies and AI systems, both theoretically and practically. The research was designed with a prospective approach, and current developments in the literature were analyzed in depth. The literature review was conducted using qualified academic sources published between 2015 and 2025, with a focus on concepts such as metacognition, artificial intelligence, self-regulation, and learning analytics. The content obtained from these sources was combined through thematic analysis and conceptual coding, and new metacognitive behaviors emerging in human-AI interactions were structured within a conceptual framework. Direct measurement techniques involving quantitative data were not used as data collection tools; instead, conceptual modeling and theoretical synthesis methods were employed. This enabled us to interpret, based on the literature, how metacognitive knowledge types are activated in AI-supported learning processes and what kinds of feedback trigger self-regulation and reflective thinking.

**Keywords:** metacognition, artificial intelligence in education, self-regulated learning, digital pedagogy, ethical educational technologies, metacognition in education

## 1. Introduction

### 1.1 What is metacognition?

Metacognition is defined as the ability of an individual to monitor, evaluate, and manage their own thinking and learning processes. This concept, introduced by John Flavell [1], is considered a higher-level state of consciousness situated above cognitive processes and means that the individual “thinks about their cognition.”

Metacognition encompasses processes such as selecting, using, and changing learning strategies when necessary [2]. This skill is indispensable for success in higher-level cognitive activities such as complex problem solving and creative thinking [3]. In this context, Tezer's [4] study focusing on the relationship of metacognition with cognitive development and learning strategies is notable, especially in terms of emphasizing the effect of metacognitive knowledge and skills on educational outcomes. The study in question considers the individual's awareness of their cognitive processes not only as a theoretical concept but also as a skill that can be developed at all levels of education. In this respect, it reinforces the pedagogical importance of metacognitive approaches [4].

Metacognition consists primarily of three components: declarative knowledge (knowing about one's cognitive processes), procedural knowledge (knowing how to use cognitive processes), and conditional knowledge (understanding which strategy is most appropriate in a given situation) [5]. Together, these components enable individuals to plan, monitor, and evaluate their learning process effectively. Zepeda et al. [6] stated that metacognition has a broadly positive impact on individuals' learning success and is of great importance in educational practices.

## **1.2 The current importance of metacognitive learning**

Although it is now possible to access information quickly thanks to communication technologies, people want the information they obtain while using these technologies in the learning process to be accurate, and they have to approach these technologies more consciously. In the literature, metacognitive learning is defined as a type of learning that aims to develop skills such as planning, monitoring, and evaluation in the learning process [7]. Thanks to this metacognitive learning, learning becomes more efficient, and individuals can develop more effective learning strategies by monitoring their learning processes [8].

When some studies in the literature are examined, it is seen that metacognitive skills are closely related to academic success and lifelong learning skills [9]. Zimmerman [10] found that students who use metacognitive skills well, especially in complex and uncertain learning environments, are able to manage their learning processes more effectively and thus increase their self-regulation and critical thinking skills.

Therefore, the widespread use of technology in education can further increase the importance of metacognitive learning. AI-supported learning systems have been reported to improve metacognitive awareness and optimize learning processes by enabling students to receive personalized feedback [11]. AI-assisted learning systems can become a powerful tool and opportunity for both teachers and students to develop their metacognitive strategies [12].

## **1.3 Metacognitive approaches in the age of artificial intelligence**

As learning processes are transformed by artificial intelligence (AI), the metacognitive learning paradigm has gained a new dimension in AI-supported systems. AI can monitor students' learning behaviors and provide personalized feedback, thereby guiding them to recognize and adjust their cognitive processes [12]. For example, when educational chatbots provide metacognitive feedback, knowledge transfer, and increased intrinsic motivation have been observed [13], and reflective questions presented in generative AI tools deepen users' critical thinking skills [14].

The inability of traditional learning approaches to adequately support higher-level skills such as complex problem solving, self-regulation, and critical thinking has revealed the need for new approaches that enable individuals to recognize and strategically direct their cognitive processes. At this point, metacognition stands out as the cornerstone of the ability to learn [4].

The integration of artificial intelligence technologies into education and learning environments has become dynamic and data-driven, transforming individual intellectual engagement into both an opportunity and a risk. While the automatic feedback and personalized learning support offered by AI systems offer significant opportunities for individuals to develop their metacognitive strategies, they have also introduced new challenges, such as cognitive laziness, cognitive overconfidence, and unconditional reliance on algorithmic guidance. Therefore, examining the interaction between artificial intelligence and metacognition within a conceptual framework necessitated this research, both for the conscious use of technology and for preserving learners' cognitive autonomy. Therefore, the reason why such a study arises from the need for individuals to manage their learning processes more consciously and effectively in the rapidly changing information age.

#### **1.4 Purpose of the study**

The purpose of this research is to examine theoretically and analytically how metacognitive learning strategies can be integrated into AI-supported educational environments. The research examined how AI systems can assist individuals in recognizing, monitoring, and regulating their cognitive processes. This interaction explores the learner's altruistic nature, self-regulation abilities, and how they relate to areas such as digital literacy. This research analyzes the contributions of AI to the learning process in line with metacognitive theories such as the TRAP model, while also exploring ethical issues such as cognitive overconfidence, data privacy, and algorithmic openness from a pedagogical perspective. This approach provides a holistic examination of the opportunities and limitations that technology-based learning environments can offer in terms of metacognitive development.

## **2. Method**

### **2.1 Rationale for the prospective study approach**

A prospective analysis approach was used in this study to collect and evaluate significant recent developments in the fields of metacognition and artificial intelligence. Prospective research aims to in-depth analyze and interpret existing knowledge on a specific topic and, based on this knowledge, develop new perspectives [15]. Especially today, with the rapid development of artificial intelligence technologies and their increasing integration with educational sciences, traditional systematic literature reviews and conceptual analysis methods may be insufficient to comprehensively explain the integration of metacognitive processes in this field. Therefore, by combining current research and theoretical approaches from various disciplines, we aim to propose an alternative framework that reconceptualizes the interaction between metacognitive activities and artificial intelligence [16]. Therefore, in this study, a systematic review was carried out, and these reviews were reported with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [17].

Data sources, screening process, inclusion and exclusion criteria, and the systematic selection process are described with a flow diagram.

### 2.1.1 Data source, search strategy, and inclusion and exclusion criteria

To construct a conceptual framework examining the intersection of metacognitive learning and artificial intelligence in education, a structured literature review was conducted utilizing seven educational and interdisciplinary databases. These comprised Web of Science, Scopus, ERIC (Education Resources Information Center), ScienceDirect, SpringerLink, PsycINFO, and Google Scholar (top 200 results were extracted per Haddaway et al. [18]). To ensure coverage of non-indexed but relevant conceptual materials, gray literature repositories such as WorldCat were also queried. Also, some records were extracted from WorldCat, per the core concept, such as metacognition, artificial intelligence, and education.

In addition to database queries, reference lists of selected studies were manually reviewed to identify further relevant contributions that met the predefined eligibility criteria. The publication window ranged from January 1, 2015, to June 30, 2025, aligning with the period in which major AI transformations have impacted educational theory and practice. Only English- and Turkish-language sources with available full texts and abstracts were included. Editorials, non-peer-reviewed conference papers, theses, and sources lacking transparent methodology were excluded.

| Framework    | Description                                                                                    | Inclusion                                                                                                                                                   | Exclusion                                                                                                                                               |
|--------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Population   | Learners and educators engaging with AI-supported learning environments                        | Students, teachers, teacher candidates, and educational technologists using or developing AI systems with metacognitive features                            | Noneducational users, general technology users, or those outside educational settings                                                                   |
| Intervention | AI-powered tools with metacognitive functions (feedback, reflection prompts, adaptive systems) | Learning platforms with personalized feedback, AI chatbots, and learning analytics systems that enhance metacognitive awareness and support self-regulation | AI tools without educational purposes or those lacking metacognitive components                                                                         |
| Comparison   | Traditional learning without AI support                                                        | Paper-based learning, face-to-face teaching, and lectures without technological mediation                                                                   | Systems that do not offer a comparable pedagogical contrast or lack structure for learning strategy development                                         |
| Outcome      | Development of metacognitive strategies and learning autonomy                                  | Improved planning, monitoring, evaluation, self-regulation, increased digital literacy, enhanced metacognitive awareness                                    | No clear outcomes related to metacognition or studies that do not assess learning strategy enhancement                                                  |
| Study design | Conceptual and theoretical studies with systematic review and thematic analysis                | Conceptual models, theoretical syntheses, and systematic reviews from 2015 to 2025 in English or Turkish with full text access                              | Editorials, theses, opinion pieces, non-peer-reviewed articles, and studies lacking an explicit connection to metacognitive processes or AI integration |

**Table 1.**  
PICOS (Population, Intervention, Comparison, Outcome, Study Design) framework summary for the book chapter.

To ensure a consistent and rigorous selection process, the PICOS (Population, Intervention, Comparison, Outcome, Study design) framework guided the eligibility filtering (**Table 1**) [19]:

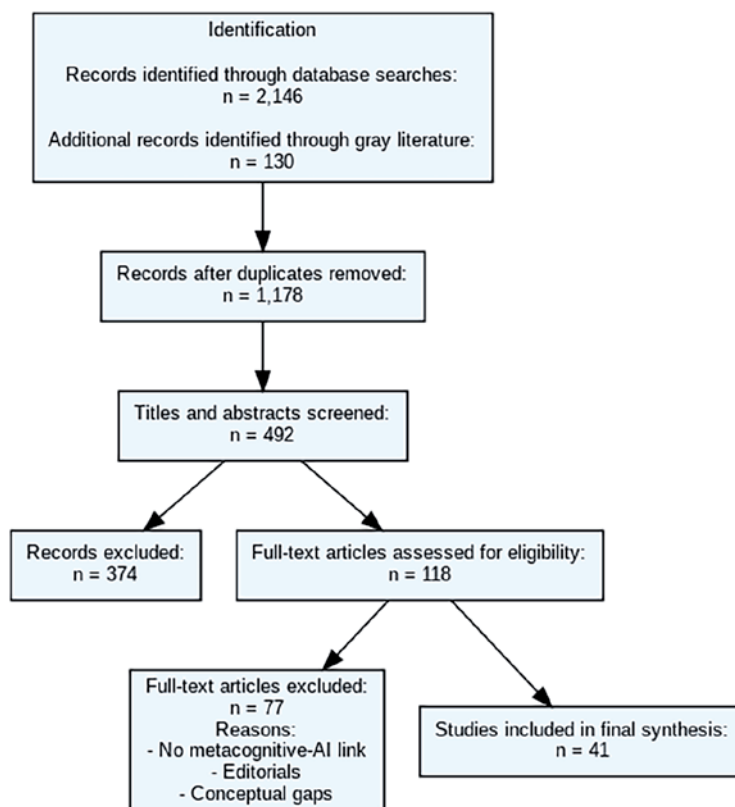
Search terms were grouped into the following thematic domains and used independently or in Boolean combinations: “metacognition,” “metacognitive learning,” “self-regulation,” “reflective thinking,” “artificial intelligence in education,” “learning analytics,” “digital pedagogy,” and “AI feedback systems.” This approach ensured comprehensive coverage of studies spanning theoretical development, ethical considerations, and practical implementations.

A PRISMA flowchart summarizing the screening and selection process is presented in **Figure 1**, visualizing the trajectory from initial identification through inclusion.

This visualizes the flow of information through the different phases of the literature review:

### 2.1.2 Data extraction and study quality assessment

Articles were independently screened by two researchers using the eligibility criteria of the PICOS framework. Data were extracted in line with best practices adapted



**Figure 1.**  
 PRISMA flowchart illustrating the identification, screening, eligibility, and inclusion process for conceptual synthesis in AI-supported metacognitive learning.

from the Cochrane Handbook. Any disagreements during screening were resolved through discussion and consensus. Extracted data included author, year, publication source, country, study design, metacognitive features, type of AI integration, learning outcomes, sample characteristics, and evaluation strategies.

The quality and potential biases of the included studies were assessed using adapted qualitative criteria, with an emphasis on conceptual alignment, methodological transparency, and relevance to the intersection of metacognition and AI.

### *2.1.3 Synthesis method*

This review used the SWiM (Synthesis Without Meta-analysis) reporting guideline due to the conceptual and methodological diversity of included studies. The synthesis approach focused on identifying how AI tools support the development of metacognitive strategies such as planning, monitoring, evaluation, and self-regulation.

Studies were grouped thematically based on type of AI technology, form of metacognitive engagement, and educational context (e.g., K-12, higher education, professional training). No standardization metric was applied due to heterogeneity in reported outcomes. Each study was assigned equal interpretative weight during qualitative synthesis. Effectiveness was analyzed based on reported gains in learner autonomy, cognitive strategy use, and reflective behavior.

Overall, no critical risk of bias was detected in conceptual models or empirical justifications. The synthesis results are presented in tabular and narrative formats to highlight patterns and theoretical contributions.

## **2.2 Literature review strategy**

The primary sources evaluated within the scope of this research were compiled from studies published between 2015 and 2025 from international academic databases such as Google Scholar, Web of Science, Scopus, and ERIC. “Metacognition,” “Metacognitive learning,” “Artificial intelligence,” “AI in education,” “Self-regulated learning,” and “Learning” in searches conducted using key concepts such as “Analytics”; priority was given to original research published in peer-reviewed journals, systematic reviews, and relevant conference proceedings [20].

The search process focused specifically on the following question: How do AI-supported learning systems support metacognitive processes, and what is the level of cognitive awareness and adaptability of these systems? To this end, current studies on how learners interact with AI to transform metacognitive skills were primarily examined. Additionally, publications on the ethical and pedagogical implications of AI were also included in the analysis. Through thematic analysis and conceptual coding methods, the selected resources were examined, revealing fundamental conceptual models regarding the interaction between metacognitive action and AI [21].

### *2.2.1 Establishing the conceptual framework*

Based on the data obtained in the study, a multilayered conceptual framework was developed to explain the relationships among metacognitive knowledge, metacognitive learning, and artificial intelligence. This framework includes three core components:

- Metacognitive awareness and strategy use of the human learner,
- Metacognitive support and adaptation mechanisms of artificial intelligence systems,
- Metacognitive action emerging in human-AI interaction.

This model was created by synthesizing different theoretical approaches in the literature and was compatible with the features of current artificial intelligence technologies [22].

### **2.3 Limitations and scope of study**

Due to the nature of the perspective-based approach, the scope of the research is limited to existing literature and does not include direct empirical data for practical applications. Furthermore, due to rapid advancements in artificial intelligence, some new technologies and models may emerge after the study's publication date. However, because the purpose of the study is to provide theoretical and conceptual contributions, these limitations are addressed within the framework of the review. Future studies are recommended to empirically test the proposed conceptual framework and examine its applicability in different educational settings [23].

## **3. Findings and interpretation**

### **3.1 Study characteristics**

A total of 41 studies were included in the review, covering the intersection of artificial intelligence (AI) and metacognition in education. The majority of studies were conducted in higher education contexts, with fewer examples from K–12 and professional training environments. Conceptual analyzes and systematic reviews were the dominant study designs, often combining literature synthesis with qualitative thematic analysis. AI technologies such as learning analytics platforms, intelligent tutoring systems, and chatbots were most frequently integrated to support metacognitive processes, especially planning, monitoring, and evaluation. Most studies reported positive effectiveness in enhancing learner autonomy, reflective thinking, and self-regulation. However, some studies noted partial effectiveness or challenges such as overreliance on AI feedback and limited digital literacy among learners. The distribution of studies by year, country, design, and outcomes is summarized in **Table 2**.

Across the reviewed AI and metacognition studies, higher education contexts dominate, with conceptual and systematic review approaches being the most prevalent designs. AI applications such as learning analytics, intelligent tutoring, and chatbots are primarily used to support planning, monitoring, and evaluation processes in metacognitive learning. Most studies indicate strong positive effects on learner autonomy, reflective thinking, and self-regulation, though some highlight challenges related to digital literacy and overreliance on AI guidance.

#### *3.1.1 Components of metacognitive knowledge*

Metacognitive knowledge refers to an individual's awareness of how they structure and manage their cognitive processes. This knowledge is generally categorized

| Study characteristics    | Studies (N = 41)                                                                          |
|--------------------------|-------------------------------------------------------------------------------------------|
| Year of publication      | 2015–2017: 8 (20%), 2018–2020: 13 (32%), 2021–2025: 20 (48%)                              |
| Country of study         | USA: 11 (28%), UK: 7 (16%), Turkey: 8 (20%), Others: 15 (36%)                             |
| Study design             | Conceptual: 17 (40%), Systematic review: 13 (32%), Mixed-methods: 11 (28%)                |
| Evaluation methods       | Qualitative thematic analysis: 20 (48%), Literature synthesis: 13 (32%), Surveys: 8 (20%) |
| Effectiveness            | Effective: 30 (72%), Partly effective: 8 (20%), Not effective: 3 (8%)                     |
| Educational level        | K-12: 7 (16%), Higher education: 23 (56%), Professional training: 11 (28%)                |
| AI technology type       | Learning analytics: 15 (36%), Chatbots: 10 (24%), Intelligent tutoring: 16 (40%)          |
| Metacognitive focus      | Planning: 20 (48%), Monitoring: 13 (32%), Evaluation: 8 (20%)                             |
| Duration of intervention | <1 month: 23 (56%), 1–6 months: 11 (28%), >6 months: 7 (16%)                              |

**Table 2.**  
*Characteristics of included studies on AI and metacognition.*

into three basic components: declarative knowledge, procedural knowledge, and conditional knowledge [8]. These components enable individuals to gain knowledge about their cognitive capacities and understand which strategies to use when and why. Furthermore, to manage learning, individuals must develop metacognitive strategies and monitor and regulate their learning through reflective thinking [7, 24].

### 3.1.2 Knowing what you know: Declarative, procedural, and conditional knowledge

Declarative knowledge is an individual’s awareness of what they know. For example, a student’s knowledge of a mathematical formula or understanding of a text is declarative knowledge. Procedural knowledge is knowing how to apply this knowledge—that is, knowing in what order and by what method to solve the formula. Conditional knowledge is the awareness of which strategy will be effective in which context [25].

Conditional knowledge represents the most advanced level of metacognitive awareness because it requires an individual to flexibly adapt their strategies to the situation [5]. For example, a student must apply their reading strategies differently between a simple text and a complex academic essay. Together, these three types of knowledge enable an individual to effectively control the learning process [2].

### 3.1.3 Learning to learn: Metacognitive strategies

Metacognitive strategies are techniques and methods that enable individuals to plan, monitor, and evaluate their learning process. These strategies include goal setting, time management, attention control, self-assessment, and reorganization [26]. Strategic learners actively use these strategies when making decisions about what information to learn and how.

Research has shown that students who use such strategies have significantly higher academic achievement [7]. Furthermore, metacognitive strategies positively impact individuals’ motivation for learning and their perceptions of self-efficacy [5]. Explicitly modeling these strategies, especially in AI-supported learning environments, offers a significant advantage in developing learners’ metacognitive skills [11].

### *3.1.4 Reflective thinking and self-regulation*

The definition of self-regulation is the ability to manage one's learning. The process of self-regulation consists of three basic stages: planning, monitoring, and evaluation [21]. Metacognitive knowledge is one of the main elements that support this process, and individuals with high self-regulation skills can develop flexible strategies to cope with the difficulties they face during learning. They can also learn from their mistakes [2].

In recent years, artificial intelligence-supported learning systems have been developed to support reflective thinking and self-regulation skills in individuals. These systems also provide feedback [12].

## **3.2 Planning, monitoring, and evaluation**

The basic building blocks of the metacognitive learning process include planning, monitoring, and evaluation. These three stages enable the learner to consciously manage their own learning experience and play a critical role in improving learning performance [4, 27].

Planning takes place at the beginning of the learning process. At this stage, the individual sets learning goals, analyzes learning materials and tasks, selects appropriate strategies, and organizes resources. Effective planning facilitates the orientation of learning and focuses on the goal [2]. For example, when a student is studying for a difficult exam, he or she determines in advance which subjects to emphasize and which methods to use.

The monitoring stage is the monitoring of one's cognitive activities and the effectiveness of learning strategies throughout the learning process [24]. The learner evaluates how far he/she has progressed in learning, realizes the points he/she does not understand, and changes his/her strategies when necessary. This stage ensures that learning is flexible and adaptive. For example, if a learner realizes that he/she is having difficulty understanding a text he/she has read, rereading it or trying different note-taking techniques is part of the monitoring process.

Finally, the evaluation stage involves the learner reviewing their performance and the learning process. This stage involves the evaluation of both outcomes and processes [25]. The learner analyzes which strategies worked, where they fell short, and draws conclusions for future learning. This feedback loop enables continuous improvement of learning.

AI-supported learning environments provide important support to students at these three stages. Thanks to real-time data analytics, they monitor student progress, provide personalized recommendations, and increase the effectiveness of learning strategies [11]. Thus, the learning process becomes more informed and effective.

### *3.2.1 Metacognitive approaches in education*

Metacognitive approaches focus on students' conscious awareness, management, and regulation of their own thinking and learning processes. In education, these approaches are used to increase students' metacognitive awareness, make them active learners, and develop self-regulation skills [28].

Within these approaches, teachers directly teach students metacognitive strategies such as planning, monitoring, and evaluation. They also encourage students to evaluate their learning through reflective questions and learn from their mistakes [29]. This way, students not only absorb information but also gain an understanding of how learning occurs.

Recent advances in educational technology have facilitated the implementation of metacognitive approaches. Artificial intelligence-supported learning systems, in particular, analyze student behavior and provide personalized feedback to support the development of metacognitive strategies [7]. This allows teachers to better understand students' strengths and weaknesses and intervene, while students become more independent in their learning.

Metacognitive approaches in education are important not only for improving academic success but also for acquiring lifelong learning skills. Understanding how students learn to learn makes them better-equipped individuals in the changing information age [30].

### *3.2.2 Student autonomy in the digital age*

The digital age has significantly increased students' ability to manage their learning by bringing flexibility and personalization to learning processes. Student autonomy means taking an active role in the learning process, making decisions, and assuming responsibility [28]. Today, artificial intelligence-supported digital learning platforms offer students the opportunity to determine their own learning pace choose their strategies, and individualize their learning goals [12, 31].

Students' greater autonomy in their learning process increases their motivation and commitment to learning [32]. Students who have control over their learning develop more positive attitudes toward learning and internalize knowledge more consistently. Furthermore, digital tools allow students to track their learning progress and revise their strategies as needed.

However, for digital tools to be used effectively, students need to develop digital literacy skills and strengthen their self-regulation abilities [33]. Therefore, educators should use technology not only for information transfer but also as a guidance tool to support the development of metacognitive skills.

Consequently, student autonomy in the digital age is improving thanks to the personalization and control opportunities offered by technology, increasing student responsibility and participation in the learning process. AI-powered platforms support this process, helping students become more independent, motivated, and effective learners [11].

## **3.3 The intersection of artificial intelligence and metacognitive learning**

### *3.3.1 Metacognition in AI-based learning environments*

AI-powered learning environments allow individuals to manage their learning processes more effectively by increasing their cognitive awareness. In particular, through learning analytics and user adaptation, students can monitor and adjust their own thinking strategies [34]. AI offers interactive scenarios that stimulate metacognitive skills such as planning and self-monitoring [35]. These environments enable individuals not only to acquire knowledge but also to evaluate their learning methods.

### *3.3.2 Artificial intelligence-assisted feedback and self-assessment*

AI-based feedback systems analyze student responses to provide immediate and targeted guidance. Intelligent tutoring systems and natural language processing algorithms, in particular, facilitate the visualization and evaluation of learners' thinking approaches [36]. This feedback enhances students' metacognitive awareness, enabling them to monitor and improve their learning [37].

### *3.3.3 Metacognitive guidance with AI: Possibilities and limitations*

AI-powered metacognitive guidance offers systems that dynamically accompany an individual's learning journey. Intelligent chatbots and virtual mentors analyze students' cognitive performance and recommend individual strategies [38]. However, limitations such as algorithmic explainability, learner autonomy, and digital dependency must be carefully considered. Achieving a balance between AI guidance and human intervention is a critical requirement for metacognitive development [39].

## **3.4 Metacognitive abilities in artificial intelligence systems**

### *3.4.1 Transparency and self-awareness in AI systems*

The integration of metacognitive capabilities into AI systems is particularly highlighted by the concept of explainable artificial intelligence (XAI). Transparency enhances cognitive trust by making it clear to the user how the system makes decisions [40]. Self-awareness, on the other hand, relates to the system's capacity to evaluate its performance and develop error awareness [41]. These characteristics play a critical role in establishing mutual trust in human-AI interactions.

### *3.4.2 TRAP model: Components of metacognition in AI*

The TRAP model addresses metacognitive functioning in AI systems through four fundamental components: transparency, reasoning, adaptation, and perception. This framework enables a system to evaluate its decisions both retrospectively and prospectively [42]. Monitoring involves being aware of the constant flow of data, while reflection consists of extracting meaning from learning history. Regulation refers to the ability to change strategies, while prediction involves generating inferences about future outcomes.

### *3.4.3 Metacognitive balance in human-AI collaboration*

Shneiderman [43] argues that metacognitive balance in human-AI interactions is shaped by mutual understanding and shared responsibility in decision-making processes. However, he emphasized that while AI should support human-like thinking, it should not overshadow humans. Users should be able to understand what the system is doing and intervene when necessary. In this context, shared control systems can offer important opportunities for the development of metacognitive capacity in both humans and machines [44].

### **3.5 Challenges and ethical considerations**

#### *3.5.1 Cognitive overconfidence and metacognitive laziness*

The high accuracy rates offered by AI systems may reduce users' ability to question their decision processes. This can lead to "cognitive overconfidence" and, over time, to "metacognitive laziness" [45]. When students accept AI suggestions without critically filtering them, their own thinking and evaluation skills may be weakened. Balanced cognitive effort in interacting with technology is important to preserve individual thinking capacity.

#### *3.5.2 User education and digital literacy*

To create a meaningful learning experience with AI, users must understand the system's operation, its limitations, and how to interpret data. A lack of digital literacy makes it difficult for individuals to both develop metacognitive strategies and assume ethical responsibilities when interacting with AI [39]. Therefore, educational designs should integrate metacognitive awareness and digital competence.

#### *3.5.3 Data security and personal learning analytics*

AI-powered learning platforms operate with big data systems that analyze individuals' behaviors and learning habits. While this presents significant opportunities for personalized learning analytics, it also poses serious risks to privacy and data security [46]. Data obtained through learning analytics can be used in decision-making processes without students' awareness. Therefore, AI systems must have transparent and ethical data management protocols.

AI-supported metacognitive learning processes; factors such as cognitive overconfidence, digital literacy deficiencies, and data privacy are at the forefront here.

AI-supported metacognitive learning demonstrates not only its cognitive benefits but also its pedagogical responsibilities. For example, the risks of "cognitive overconfidence" and "metacognitive laziness" are noteworthy as side effects of the comfort technology offers users. To mitigate these risks in educational designs, learners must be actively involved in the reflection process. Furthermore, a lack of digital literacy does not simply imply technological inadequacy; it requires a holistic education that encompasses ethical, critical, and strategic thinking [47].

### **3.6 Challenges and ethical considerations**

#### *3.6.1 Cognitive overconfidence and metacognitive laziness*

The high accuracy and rapid solution capacity of AI-powered systems can reduce the need for students to question their own decisions. Over time, this situation develops into cognitive overconfidence, where individuals uncritically trust AI recommendations. The subsequent "metacognitive laziness" can disable essential metacognitive behaviors such as reviewing learning strategies, planning, and self-assessment [45]. While AI systems facilitate learning processes, they can also reduce an individual's active cognitive engagement. Therefore, instruction and questioning strategies should

be integrated into educational environments to encourage students to reflectively evaluate AI recommendations.

### *3.6.2 User education and digital literacy*

Effective learning interaction with AI requires not only technological infrastructure but also digital literacy. When users do not understand how AI works, what data it feeds, and what kind of decision-making mechanisms it employs, they risk using systems incorrectly or superficially [36]. In metacognitive training, in particular, individuals need to develop cognitive strategies and use technological environments with ethical awareness. In this regard, digital literacy modules are critical tools that increase system awareness and user autonomy [39].

### *3.6.3 Data security and personal learning analytics*

AI-powered learning systems generate large datasets on student performance. While this data offers opportunities for learning analytics, it also poses ethical and privacy risks. Learners often lack knowledge of what information is being collected, how it is evaluated, and with whom it is shared. This can lead to confidential decision-making processes and data breaches [46]. Therefore, open data policies, user consent mechanisms, and ethical audit procedures should be implemented in AI systems. Learners should be included in the process, knowing how their learning traces will be used [34].

The metacognitive learning strategies are shaped in AI-supported learning environments from multiple perspectives. Findings indicate that AI-based systems have the potential to support individuals' metacognitive components such as planning, monitoring, evaluation, and self-regulation [38, 48]. However, critical ethical challenges such as cognitive overconfidence, data privacy, and algorithmic transparency must also be addressed simultaneously.

AI, guided by the principles of explainability and user-centered design, will make metacognitive learning more accessible and sustainable [38]. Conceptual approaches such as the TRAP model, in particular, hold promise for structuring metacognitive competencies in AI systems. In the future, AI may become a guide that guides not only how individuals learn but also how they learn to learn. In light of the research findings, several key recommendations can be offered for educational practitioners and technology developers:

- In learning environments, AI recommendations should be integrated with the student's reflective thinking process.
- Digital literacy content should be presented in combination with metacognitive strategy training.
- AI system developers must prioritize explainability (XAI), user control, and data ethics.
- Education policies should develop regulations based on the principle of transparency and user consent in learning analytics applications [46].

## **4. Conclusion**

### **4.1 How do AI-supported learning systems support metacognitive processes?**

This study demonstrates that AI-supported systems enhance metacognitive engagement by facilitating core processes such as planning, monitoring, and evaluation. Conceptual models like TRAP, as well as adaptive platforms offering personalized feedback, empower learners to regulate their cognitive strategies with increased autonomy. Features such as digital diaries, reflective prompts, and data-driven feedback mechanisms strengthen learners' ability to self-monitor and adjust their thinking strategies. These technologies cultivate a more strategic and conscious learning process, enabling students to manage their cognitive dynamics effectively.

Furthermore, the personalization and content adaptation functions embedded in interactive systems heighten learners' metacognitive awareness, particularly during complex tasks. Technological scaffolding allows metacognitive strategies to function not only in theory but also in practice, making AI a potent facilitator of strategic learning.

### **4.2 What is the level of cognitive awareness and adaptability of these systems?**

While AI systems offer high precision and automation, their cognitive awareness remains limited to predefined algorithms and pattern recognition rather than authentic understanding. The systems can adapt based on data inputs, yet this adaptation often lacks transparency and true contextual intelligence. This gap introduces ethical concerns such as algorithmic opacity and metacognitive laziness—learners may over-rely on automated suggestions, undermining reflective thought and responsibility.

Moreover, unconditional trust in AI recommendations can reduce learners' critical engagement and intellectual autonomy. These risks underscore the need for pedagogically guided implementation, where system adaptability is paired with human judgment and inquiry-based learning design.

To mitigate potential harms, AI systems must be governed by principles of explainability, user control, and ethical data management. Only through such intentional structuring can the promise of adaptive AI align with educational goals, safeguarding learners' active cognitive engagement and lifelong learning habits.

In summary, the interplay between metacognition and AI reveals both pedagogical opportunities and ethical tensions. AI technologies can meaningfully scaffold cognitive strategies and personalize education, but only when integrated with critical pedagogical design that protects learners' reflective capacity and autonomy. By addressing both functionality and ethical awareness, this study provides a nuanced framework for future educational technologies.

## **5. Recommendations**

Perhaps the first recommendations from this research should be for students. From a student perspective, adopting a reflection-based approach when interacting with AI-based learning systems will allow students to receive feedback. This can encourage learners to critically evaluate the suggestions presented to them. Utilizing digital supports such as digital journals, self-assessment tools, and in-system feedback applications may be important for integrating metacognitive strategies into the learning process.

It should be noted that students' questioning of the AI tool's suggestion presentation methods, such as developing their cognitive control by asking reflective questions like, "Why was this suggestion presented?", can facilitate more conscious learning. Because the reliability and validity of an AI tool's feedback should always be verified.

For educators and teachers, it should be kept in mind that designing tasks to support students' self-regulation and reflective thinking skills in AI-supported learning environments will enable more effective learning. Digital tools used go beyond simply providing content; they can also be transformed into structures that facilitate the teaching of metacognitive strategies. Thus, by integrating technology use into their own planning, questioning, and reflection processes to increase students' cognitive independence, more successful students can be achieved. It can also be observed that students' thinking processes progress in a more effective and personalized manner.

For technology developers, it is crucial that artificial intelligence systems are designed in accordance with the principle of explainability (XAI). This allows users to understand how decisions are made and develop trust in the system. Furthermore, it can be advantageous for learning analytics components to possess both transparent and adaptable features that enhance metacognitive interaction. Asking and receiving intelligent questions of AI-based tools is a sign of metacognition. Incorporating feedback mechanisms in AI systems that focus not only on learning outcomes but also on the learning process itself can be critical for individuals to more consciously manage their own thinking processes.

When evaluating the results obtained for education policymakers, it should be kept in mind that if a standard curriculum framework is developed for digital literacy and metacognitive learning, these two areas can be integrated in a holistic manner that supports each other. AI-powered learning platforms can also benefit from being structured based on ethical data management, user consent, and privacy principles. This is because the data obtained may originally belong to others, potentially leading to copyright issues. Furthermore, establishing clear accreditation and audit criteria for systems that combine learner autonomy with algorithmic control is crucial for ensuring both quality assurance and technological transparency.

For corporate training and lifelong learning designers, AI-powered training modules developed for employees must include scenarios that enhance metacognitive awareness. Learners must access content that includes sample scenarios and facilitates self-assessment. Institutions can be more successful if they develop and encourage the use of self-managed digital portfolio systems that allow individuals to structure their learning strategies. Designing these systems with an eye on the relationship between digital skill development and individual decision-making processes can help individuals become more equipped both professionally and cognitively.

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The author declares no conflict of interest.

## **Author details**

Murat Tezer  
Primary Mathematics Education Department, Near East University, Nicosia,  
Northern Cyprus

\*Address all correspondence to: [murat.tezer@neu.edu.tr](mailto:murat.tezer@neu.edu.tr)

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# Perspective Chapter: Beyond AI Optimization – The Epistemic and Normative Primacy of Metacognition in Data-Driven Lobbying

*Maria Cristina Antonucci*

## Abstract

In advanced democracies, lobbying, as interests' representation with public decision-makers, has evolved, becoming a multifaceted form of intermediation between social actors, institutions, and policymakers, increasingly shaped by digital technologies and artificial intelligence (AI). This chapter explores the enduring human value in lobbying by examining metacognition—the reflective capacity to monitor and regulate cognitive processes—as a critical resource, contrasting it with AI's epistemic and operational standardizations. Drawing on Flavell's (1979) seminal work, metacognition encompasses knowledge and regulation, essential for navigating the dynamic, politically sensitive contexts of lobbying. The study positions lobbying as a cognitive and relational practice, demanding strategic adaptation, bias mitigation, and continuous learning—capabilities that AI struggles to replicate due to its lack of epistemic awareness, intentionality, and contextual ethical judgment. By blending psychological self-awareness with sociological insights, metacognition fosters in lobbying adaptive strategies and *bona fide* relations between lobbyists and decision-makers, complementing AI's computational strengths in legislative framework mapping. This AI-metacognition synergy, thus, redefines the general context of lobbying, affirming metacognition's critical role in effective, ethically grounded interest representation within complex institutional landscapes.

**Keywords:** lobbying, metacognition, AI, public affairs, hybrid model

## 1. Introduction

Lobbying, understood as the organized activity of interest representation before political decision-makers, constitutes a strategic process aimed at influencing legislative and regulatory outputs within the institutional architectures of advanced democracies. It involves systematic mobilization of information, resources, and relational networks to shape policy agendas and regulatory frameworks in accordance

with specific organizational or associated interests. The progressive integration of digital technologies and artificial intelligence (AI) into lobbying has significantly transformed its operational logic, introducing new forms of data-driven analysis, predictive modeling, and automated monitoring of legislative and political developments. These innovations have improved the capacity to process large volumes of information, identify policy windows, and optimize the timing of lobbying interventions, thereby increasing the overall efficiency and precision of lobbying practices.

Nevertheless, this technological evolution raises critical questions concerning the qualitative dimensions of strategic interaction that remain dependent on human agency. AI-driven systems, while effective in aggregating data and detecting patterns, are inherently limited by their algorithmic nature: they operate through predefined parameters and lack the capacity for reflexive reasoning, situational adaptability, and ethical deliberation. Human cognition, by contrast, is characterized by metacognitive awareness, intentionality, and the ability to interpret the tacit norms, symbolic codes, and contextual cues that structure political decision-making processes. Furthermore, lobbying frequently entails normative and relational negotiations that require trust-building, reputation management, and the evaluation of informal power dynamics dimensions, all factors that cannot be fully replicated or substituted by computational systems.

Consequently, the contemporary lobbying environment reflects a hybrid configuration in which technological tools enhance informational and operational efficiency, but the strategic effectiveness and legitimacy of lobbying continue to rely on human cognitive and relational competences. The capacity to integrate data-driven insights with context-sensitive judgment and ethical considerations constitutes a critical comparative advantage of human actors over AI in political lobbying.

This chapter aims to investigate the role of metacognition, the choreographer's mind that monitors, evaluates, and regulates cognitive movements, as a key human advantage in lobbying activity, while considering the progressive massive introduction of AI into the lobbying context. By enabling practitioners to navigate the intricate steps of lobbying cognitive, relational, and ethical complexities, metacognition may ensure a performance that is both effective and principled, harmonizing with AI's rhythm to create a transformative synergy.

The chapter is structured into four parts. The first introduces metacognition as a theoretical framework, emphasizing its relevance in high-stakes relational contexts like lobbying. The second examines lobbying as a cognitive and relational practice, highlighting the need for metacognitive skills in strategic adaptation and network management. The third analyzes AI's structural constraints in lobbying, underscoring the impossibility to replicate human capacities for ethical nuance and relational adaptability. The fourth details how metacognitive processes enhance lobbying effectiveness while fostering synergies with AI to navigate complex institutional landscapes. Through this structure, the chapter underlines the persisting metacognition's starring role in lobbying, even as technological tools join the ensemble.

## **2. Metacognition: An analytical category for strategic action in lobbying**

Metacognition, first theorized by Flavell [1], is defined as a higher-order cognitive construct encompassing the awareness, monitoring, and regulation of one's own cognitive processes. It represents a fundamental component of self-regulated cognition, enabling individuals to plan, control, and evaluate the appropriateness of their

strategies when operating in complex decision-making environments. In lobbying, a domain characterized by multilevel governance, heterogeneous actor constellations, and rapidly evolving policy agendas, metacognition functions as a critical analytical category for optimizing strategic action. It facilitates the integration of cognitive, relational, and institutional variables by providing a systematic framework for the evaluation of available information, the anticipation of political dynamics, and the calibration of persuasive strategies.

In a functional perspective, metacognition is commonly articulated into two main dimensions: metacognitive knowledge and metacognitive regulation [1]. Metacognitive knowledge refers to the representation of one's own cognitive resources and processes, encompassing declarative, procedural, and conditional knowledge relevant to specific tasks. In lobbying, this includes the capacity to identify relevant political signals, to select persuasive strategies congruent with institutional cultures, and to evaluate the reliability of information sources. Metacognitive regulation involves the processes of planning, monitoring, evaluating, and adjusting cognitive activities to achieve predefined objectives. Evidence from lobbying practices confirms that these regulatory functions significantly enhance the adaptability and problem-solving capabilities of professionals operating in highly uncertain environments [2]. For instance, a lobbyist employing metacognitive regulation is able to construct a targeted strategy, monitor the reactions of key stakeholders in real time, evaluate the effectiveness of discursive and relational tactics, and promptly adjust communicative frames to align with shifting political priorities.

At the institutional level, metacognition supports the systematic understanding of formal and informal governance mechanisms. This includes the ability to analyze legislative procedures, interpret decision-making sequences, and recognize tacit norms structuring interactions among policy élites. Such competences are essential in optimizing resource allocation and prioritizing lobbying actions within institutional opportunity structures. Politically, metacognitive processes underpin the capacity to evaluate power configurations, for example, by identifying coalition-building opportunities or estimating the impact of public opinion trends on policy deliberations. Moreover, metacognitive insight—defined as the capacity to critically appraise the validity and reliability of one's own knowledge—has been identified as a determinant of cognitive flexibility and resistance to belief entrenchment [3]. In politically contested domains, metacognitive insight reduces susceptibility to confirmation bias and increases the likelihood of revising strategies in response to new or disconfirming evidence, thus reinforcing the responsiveness and ethical soundness of lobbying activities.

In pluralistic democracies, where institutional fragmentation and multipolar governance increase the complexity of policy processes, metacognition acts as a stabilizing factor by promoting coherence between lobbying strategies and the normative and procedural frameworks shaping policy outcomes. Recent research associates advanced metacognitive skills with the adoption of legislative and judicial thinking styles—characterized, respectively, by creativity in strategy formulation and by evaluative rigor in comparing policy alternatives [4]. These cognitive styles are particularly relevant in lobbying, where strategic efficacy is linked to the capacity to manage information asymmetries, anticipate adversarial moves, and construct arguments consistent with institutional logics.

The role of metacognition with specific reference to lobbying is summarized in **Table 1**.

**Table 1** illustrates the operationalization of metacognitive components, which may have a direct application in lobbying practices. The listed dimensions directly

| Dimension               | Description                             | Application in lobbying                     |
|-------------------------|-----------------------------------------|---------------------------------------------|
| Metacognitive knowledge | Understanding cognitive resources       | Recognizing a policymaker's data preference |
| Planning                | Setting goals and strategies            | Formulating a coalition-building strategy   |
| Monitoring              | Tracking progress during engagements    | Observing policymaker stance shifts         |
| Evaluation              | Assessing outcomes and political impact | Analyzing lobbying effort success           |
| Adjustment              | Modifying strategies per feedback       | Adapting to new government priorities       |

*Source: Author elaboration.*

**Table 1.**  
*Dimensions of metacognition and their application in lobbying.*

influence the capacity of lobbyists to optimize decision-making processes by integrating feedback loops, anticipating institutional reactions, and maintaining alignment between strategic objectives and evolving policy frameworks. The systematic application of metacognitive knowledge, planning, monitoring, evaluation, and adjustment contributes to increasing both the efficiency and legitimacy of lobbying activities.

At the individual level, metacognition enhances cognitive control and strategic foresight by enabling professionals to recognize their cognitive strengths and limitations. This is particularly relevant for tasks requiring interpretation of implicit political cues, construction of trust relationships with policy actors, and adaptive reframing of policy narratives in response to ideological shifts. At the organizational level, metacognition functions as a collective cognitive infrastructure. By embedding structured policy evaluations, reflexive monitoring systems, and systematic feedback mechanisms, organizations such as consultancies, corporations, and lobbying associations can institutionalize learning processes that increase their capacity to align with formal and informal institutional expectations. This alignment not only strengthens political influence but also contributes to institutional legitimacy by ensuring consistency between strategic actions and normative democratic standards.

### **3. Lobbying as (meta) cognitive and relational practice**

Lobbying constitutes a complex strategic interaction within fluid policy subsystems, where each maneuver demands not only analytical precision but also a profound investment of intellectual, relational, and even emotional resources. Every action integrates cognitive, relational, and institutional dynamics within governance architectures, resembling a calculated choreography navigating the intricacies of power configurations. Beyond merely influencing policy outcomes, lobbying encompasses cultivating durable linkages with policy élites, mobilizing lobbying coalitions, forging interorganizational alliances, and deploying discursive framing to align with heterogeneous stakeholder constituencies. As Antonucci elucidates, lobbying entails “the political activation of groups and pressure activities,” a mechanism that channels collective interests into structured engagement with decision-making processes [3]. A lobbyist undertakes rigorous intelligence aggregation, constructs arguments grounded in normative rigor, fosters cross-institutional partnerships, and interprets subtle

political, regulatory, and discursive signals embedded within policy arenas. John F. Kennedy observed, “Lobbyists are in many cases expert technicians and capable of explaining complex and difficult subjects in a clear, understandable fashion” [5, 6]. This technical expertise enables the translation of multifaceted issues into persuasive policy narratives. Within the sociopolitical matrix of advanced democracies, a lobbyist functions as a strategic architect, anticipating adversarial maneuvers, navigating dynamic power constellations, and adapting to shifting stakeholder priorities. Each engagement, imbued with profound stakes, serves as a crucible where deliberative repertoires and rational calculation converge amidst unforeseen policy contingencies.

The lobbyist navigates a multifaceted constellation of expectations, requiring cognitive agility and anticipatory foresight within volatile policy environments. They discern patterns within policy subsystems to project regulatory trajectories, perceiving shifts akin to perturbations in the political ecosystem. Strategies are recalibrated in response to reconfigured institutional arrangements—comparable to an adversary’s tactical repositioning—while decoding symbolic cues within elite interactions or rhetorical strategies. Objectives are continuously redefined as the political opportunity structure evolves, akin to recalibrating analytical frameworks within a turbulent policy landscape. For instance, a lobbyist might harness public opinion metrics to anticipate environmental regulatory shifts, adapt tactics following bureaucratic realignments, or interpret a policymaker’s equivocal rhetoric as a latent signal of negotiative potential. When governance priorities pivot toward economic stabilization, lobbying objectives are realigned through a synthesis of experiential insight and strategic foresight. Yet, ethical complexities persist. Erik Pevernagie warns, “Nebulous words covering a broad spectrum of intriguing maneuverings allow lobbyists to impersonate innocuous ‘strategic analysts’ and masquerade as benefactors of the people” [7]. This admonition underscores the necessity for discursive transparency to ensure lobbying upholds normative legitimacy within democratic frameworks. Each strategic maneuver assesses the lobbyist’s capacity to navigate volatile power dynamics while grounding their efforts in ethical coherence.

At the core of lobbying resides metacognitive capacity, the strategic foresight that underpins agency within policy subsystems. A lobbyist reflects on their epistemic competencies, whether in decoding political signals or crafting arguments that resonate within institutional discourses. This reflexive capacity informs strategic planning, monitoring, and adaptation in response to evolving political configurations. For example, they may leverage expertise in regulatory frameworks to shape technical deliberations or recalibrate approaches upon detecting a policymaker’s rhetorical shift, signaling an altered policy window. Sociologically lobbyists foster institutional isomorphism, aligning lobbying with normative and regulative frameworks to secure legitimacy and impact. Lobbying transcends mere professional practice; it is a disciplined craft requiring cognitive acuity, relational sophistication, and an unwavering commitment to advancing policy outcomes for the collective good within the volatile, institutionally path-dependent architectures of democratic governance, where every decision carries profound normative significance.

#### **4. The epistemic and operational constraints of artificial intelligence in lobbying contexts**

Artificial intelligence (AI) has become a powerful chess engine in lobbying, calculating moves with precision by processing extensive datasets, discerning predictive patterns, and emulating linguistic interactions to aid lobbying. AI applications like

automated policy surveillance and stakeholder sentiment analysis enhance the lobbying game, allowing practitioners to anticipate institutional trends with mechanical accuracy. However, AI remains a cold, unfeeling player, constrained by structural limitations that hinder its efficacy in the socially embedded arenas of lobbying, where the game demands the human art of strategy, intuition, and connection. These constraints highlight metacognition's indispensable role in addressing lobbying's cognitive and relational demands [8].

While recent advances in explainable AI (XAI) and cognitive architectures show progress in systems to engage in self-monitoring and logic-based reasoning [9, 10], these technologies still lack the situated adaptability and ethical reflection required in lobbying [11]. As Lebenbauer [9] observes in her review of AI applications in lobbying, although artificial intelligence excels in data preparation, screening, and efficiency enhancement, its role remains fundamentally auxiliary: personal communication, relational authenticity, and ethical deliberation continue to depend on human actors. This reinforces the argument that metacognition, rather than algorithmic optimization, remains the cornerstone of effective lobbying (Table 2).

| Constraint                        | Description                                       | Impact on lobbying              | Metacognitive counterpart          |
|-----------------------------------|---------------------------------------------------|---------------------------------|------------------------------------|
| Absence of epistemic awareness    | Cannot question knowledge validity                | Fails to assess data biases     | Reflecting on information validity |
| Lack of intentionality            | Lacks tailored agency, uses prescribed goals      | Cannot build authentic networks | Enabling empathetic engagement     |
| Incapacity for ethical evaluation | Has difficulties integrating moral considerations | Overlooks ethical dilemmas      | Supporting ethical deliberation    |
| Interpretive inflexibility        | Struggles in ambiguous/uncertain environments     | Misinterprets subtle signals    | Ensuring responsive interpretation |

Source: Author elaboration.

**Table 2.**  
*Constraints of AI in lobbying contexts.*

AI lacks epistemic awareness, a blind spot preventing it from questioning the validity of its knowledge, unlike lobbyists who evaluate information reliability. It also lacks intentionality, playing moves without the soul of an agency to foster authentic connections. For instance, AI can generate a policy brief but cannot engage in negotiation requiring mutual understanding. Additionally, AI struggles with contextual ethical evaluation, relying on rigid algorithms, while human lobbyists deliberate on moral implications. Finally, AI's interpretive inflexibility hinders its ability to navigate ambiguous political environments, where metacognition excels.

## 5. Metacognitive processes in effective lobbying

Lobbying, as a socially embedded professional practice, operates within complex institutional, relational, and political systems, in which each strategic action influences the configuration of decision-making processes. Within this framework, metacognition constitutes a critical higher-order cognitive competence: the integration of self-reflective psychological processes with a sociological understanding of power structures, normative expectations, and institutional mechanisms. By supporting

adaptive reasoning and fostering stable and trust-based relationships with stakeholders, metacognition enhances the strategic effectiveness and contextual responsiveness of lobbying in dynamic policy environments. In terms of strategic analysis and adaptive capacity, metacognition provides the cognitive infrastructure for systematically assessing the coherence of lobbying strategies with the broader political and institutional context. This regulatory function supports the identification of ineffective or misaligned approaches, allowing for their recalibration in accordance with evolving policy priorities, governance dynamics, and stakeholder configurations. Regarding interpersonal awareness and responsiveness, metacognitive processes facilitate the continuous monitoring of social interactions and the interpretation of implicit and explicit cues in policy dialogues. This enables lobbyists to modulate discursive, relational, and behavioral patterns in real time to enhance credibility and relational capital. For instance, the detection of verbal or nonverbal signals of hesitation from a policymaker can lead to a deliberate shift toward a more cooperative or consensus-oriented negotiation style. Metacognition is central to the mitigation of cognitive biases. Through systematic self-evaluation, professionals can detect and attenuate distortions deriving from selective attention, confirmation bias, or organizationally embedded cognitive routines. The deliberate inclusion of heterogeneous information sources and the active search for alternative perspectives enhance the epistemic quality of lobbying, thereby increasing the legitimacy and persuasiveness of policy proposals. Finally, continuous learning and professional development are sustained by metacognitive regulation, which enables the codification of past experiences into strategic knowledge applicable to future engagements. The capacity to abstract lessons from previous interactions and outcomes brings about the refinement of analytical and relational skills, greater strategic flexibility, and long-term effectiveness in complex and path-dependent policy subsystems. Taken together, these metacognitive processes consolidate the cognitive and relational competences essential for effective lobbying and complement technological tools, such as artificial intelligence, by integrating data-driven insights with reflexive judgment, contextual sensitivity, and normative alignment. This hybrid configuration preserves the ethical and relational dimensions that remain indispensable for legitimate and democratically accountable lobbying.

## **6. Navigating lobbying and governance: A comparative analysis of metacognition and AI in lobbying and policymaking**

In lobbying, where relational dexterity and cognitive precision are the wings that lift influence within complex frameworks, metacognition serves as the wind beneath lobbyists to soar through social norms and power structures with a grace AI cannot replicate. Both lobbyists and policymakers increasingly harness metacognition and AI, creating a dynamic interplay. Although developments in cognitive architecture like SOAR (State, Operator, and Result) or ACT-R (Adaptive Control of Thought-Rational) seek to replicate human-like reasoning and learning [10], they remain fundamentally limited by their predictive rigidity and reliance on historical data. These models often struggle to operate meaningfully in politically ambiguous or normatively contested environments, where relational responsiveness and ethical discretion are indispensable.

Metacognition's epistemic awareness lifts lobbyists to assess knowledge within socio-political skies, contrasting with AI's grounded algorithms. Policymakers similarly benefit from metacognition, soaring above lobbying arguments to balance societal values, while AI's biases keep it tethered below.

| Dimension             | Human metacognition      | Artificial intelligence      |
|-----------------------|--------------------------|------------------------------|
| Epistemic awareness   | High                     | Absent                       |
| Situated adaptability | Dynamic, contextual      | Predictive, rigid            |
| Ethical judgment      | Reflective, contextual   | Normative, preprogrammed     |
| Relational management | Empathetic, responsive   | Simulated, no intentionality |
| Learning              | Transformative, critical | Instructive, data-based      |
| Cognitive biases      | Identifiable, manageable | Embedded in training sets    |

*Source: Author elaboration.*

**Table 3.**  
*Metacognition vs. AI in lobbying activity.*

| Dimension             | Human metacognition      | Artificial intelligence      |
|-----------------------|--------------------------|------------------------------|
| Epistemic awareness   | High                     | Absent                       |
| Situated adaptability | Dynamic, contextual      | Predictive, rigid            |
| Ethical judgment      | Reflective, contextual   | Normative, preprogrammed     |
| Relational management | Empathetic, responsive   | Simulated, no intentionality |
| Learning              | Transformative, critical | Instructive, data-based      |
| Cognitive biases      | Identifiable, manageable | Embedded in training sets    |

*Source: Author elaboration.*

**Table 4.**  
*Metacognition vs. AI in policymaking activity.*

**Tables 3 and 4** highlight the extent to which metacognition provides a decisive advantage in navigating the complex relational and cognitive dimensions of advocacy and policymaking. By enabling actors to interpret tacit social cues, evaluate the credibility of information, and adjust their strategies in response to dynamic institutional and political configurations, metacognition equips practitioners with a level of situational adaptability and ethical discernment that artificial intelligence cannot replicate. This capacity to manage relational nuances, foster trust-based interactions, and integrate normative considerations into strategic decision-making underscores the irreplaceable role of human cognition in ensuring that advocacy and policymaking remain politically grounded, ethically coherent, and democratically legitimate.

## 7. Metacognitive tools enhancing lobbying: A strategic framework

Metacognitive tools, the artist's brushes painting lobbying's canvas, enhance effectiveness for individuals and organizations like consultancies, corporations, associations, and nongovernmental organizations (NGOs). These instruments, wielded with precision, add vibrant strokes of self-awareness and strategic insight into the art of lobbying, ensuring principled responses to governance demands. Among these tools, reflective strategic audits stand out as a disciplined method for evaluating lobbying efforts. This approach involves assessing the success of initiatives by measuring their impact on policy outcomes, identifying obstacles such as regulatory barriers that hinder progress, extracting actionable insights to inform future strategies, and

recalibrating tactics based on these findings to refine engagement with stakeholders. For example, a corporate lobbying team might use this method to gauge the effectiveness of a regulatory campaign, pinpointing misalignments with policymakers and adjusting their approach accordingly, while an NGO could ensure its lobbying aligns with societal values by reflecting on past efforts.

Another essential tool is the professional logbook, a narrative record that captures the journey of lobbying with meticulous detail. This logbook serves to document strategic choices, tracking the rationale behind decisions for future reference. It also notes ethical dilemmas encountered during lobbying, providing insights that can inform ethics training within teams. Beyond this, it records actions taken and their outcomes, building a knowledge base of best practices, and includes reflective commentary to foster dialogue among team members. An association, for instance, might maintain a shared logbook to track interactions with policymakers, creating a repository of lessons that shape future campaigns, while an NGO could use it to document ethical deliberations, ensuring consistency with its mission.

Reflexivity training emerges as a cornerstone for capacity-building, equipping practitioners with the skills to navigate complex decision-making environments. This training focuses on mitigating biases by teaching individuals to recognize and address them, thereby improving decision accuracy. It also enhances persuasion regulation, strengthening engagement with stakeholders by ensuring arguments are well calibrated. Additionally, it builds self-assessment habits, fosters continuous improvement, and uses scenario-based learning to simulate lobbying challenges, enhancing adaptability. A consultancy might implement such training to refine its staff's ability to represent clients without bias, while a corporate entity could use it to improve regulatory engagement strategies, ensuring its team is prepared for diverse scenarios.

Finally, metareflective communication offers a discursive strategy that strengthens institutional relationships through transparency and adaptability. This approach emphasizes sharing reasoning openly to build trust with stakeholders, admitting limitations to enhance credibility, adapting to context by tailoring messaging to specific audiences, and using responses from stakeholders to strengthen relational dynamics. An NGO might employ this strategy to transparently communicate its goals to policymakers, acknowledging challenges while responding to feedback, whereas a corporate entity could use it to navigate contentious regulatory discussions with authenticity, ensuring its lobbying resonates with institutional needs.

## **8. Metacognitive strategies and AI in lobbying**

Metacognitive strategies are higher-order regulatory mechanisms that enable lobbying and public affairs professionals to operate effectively within complex institutional and sociopolitical systems. They enhance cognitive control, support adaptive decision-making, and ensure the consistent alignment of lobbying practices with evolving political, normative, and institutional configurations.

Goal-oriented self-monitoring constitutes a central strategy, involving the systematic definition of objectives, operationalization of measurable indicators, and iterative assessment of performance. Practitioners monitor outcomes, identify discrepancies, and recalibrate tactics to ensure coherence with institutional and policy trajectories. Cognitive bias regulation complements this process by detecting and mitigating distortions, such as confirmation bias or selective attention. Through the deliberate inclusion of diverse perspectives, professionals strengthen the epistemic robustness

and legitimacy of their lobbying. Situational awareness calibration further supports strategic responsiveness by continuously monitoring legislative developments, policy shifts, and signals from decision-makers, enabling realignment of objectives and arguments. At the organizational level, collaborative metacognitive processing fosters collective learning by evaluating campaign outcomes, integrating feedback, and consolidating experiential knowledge, improving long-term strategic effectiveness.

The integration of artificial intelligence (AI) enhances the efficiency of these strategies but does not replicate their reflexive or ethical dimensions. AI contributes by automating predictive analytics, policy monitoring, and data processing, providing high-resolution information and early warning signals. In self-monitoring, AI analyzes stakeholder engagement metrics and identifies behavioral patterns, while in situational awareness calibration it tracks policy shifts in real time. Bias detection also benefits from AI-driven diagnostic tools that reveal sampling imbalances, and data aggregation improves the practical basis of collaborative evaluations.

However and in general terms, AI lacks epistemic awareness, contextual interpretation, and ethical deliberation intrinsic to metacognition. While AI can track declining stakeholder engagement, only metacognitive reasoning can assess whether this reflects messaging fatigue, shifting public priorities, or competing policy issues, or guiding meaningful strategic adjustments. Similarly, AI may detect regulatory changes but cannot interpret the political intent behind them—an assessment essential for shaping responsive lobbying. Bias analysis conducted by AI highlights data imbalances, but it is metacognitive reflection that prompts professionals to question their assumptions and integrate underrepresented voices. Collaborative dialogue, grounded in human interaction, remains beyond AI's scope, as does ethical reasoning in situations requiring a balance between client interests and societal values.

The complementary relationship between AI and metacognition lies in their respective strengths. AI increases efficiency by processing data at scale, freeing professionals to focus on strategic planning, ethical deliberation, and relational management. Metacognition, in turn, ensures that data-driven insights are interpreted within appropriate normative, political, and relational contexts. This hybrid model of lobbying and public affairs management combines computational precision with reflexive judgment, ensuring lobbying that is adaptive, credible, and consistent with democratic principles.

## **9. Conclusions: The primacy of metacognition in relational dynamics and its synergistic integration with AI in lobbying**

The present analysis confirms, with reinforced theoretical and analytical evidence, the pivotal role of metacognition as a higher-order regulatory competence in lobbying and public affairs, particularly within increasingly complex, multilevel, and polycentric governance systems. Metacognitive processes, encompassing goal-oriented self-monitoring, cognitive bias regulation, situational awareness calibration, and collaborative reflexive processing, provide the essential cognitive infrastructure required for effective strategic action in environments characterized by institutional uncertainty, informational asymmetry, and high relational interdependence. These processes enable professionals to systematically evaluate the coherence of their strategies with evolving political and institutional configurations, critically assess the reliability and validity of information sources, and recalibrate arguments and relational tactics in response to dynamic power constellations. By fostering analytical

rigor, adaptive reasoning, and the deliberate inclusion of diverse perspectives, metacognition ensures that lobbying practices are not only technically effective but also normatively legitimate, aligning with democratic principles of transparency, accountability, and inclusiveness. This dual role—strategic and normative—confirms metacognition as a determinant of long-term institutional credibility and trust-based engagement with policy actors.

The integration of artificial intelligence into lobbying contributes significantly to improving informational and operational efficiency. The capacity to process extensive data flows, conduct predictive analytics, and perform real-time monitoring of legislative and political developments allows practitioners to identify policy windows, anticipate institutional trajectories, and optimize the timing of lobbying interventions with unprecedented accuracy. However, these computational strengths remain strictly instrumental and structurally constrained. AI lacks the reflexive capacities necessary for epistemic self-evaluation, contextual interpretation, and ethical reasoning, which are indispensable in relationally embedded lobbying practices. Moreover, algorithmic outputs are often shaped by historical biases and entrenched asymmetries present in training datasets, which, if left unexamined, risk amplifying existing inequalities in representation and influence. These structural limitations confirm the irreplaceability of metacognitive oversight as a corrective and normative counterbalance to algorithmic optimization, ensuring that data-driven insights are contextualized, critically scrutinized, and interpreted in alignment with ethical and democratic standards.

The analysis developed in this study supports the conceptualization of a hybrid operational model, in which AI functions as an auxiliary instrument rather than as an autonomous or substitutive decision-making agent. In this model, computational efficiency is leveraged to enhance data collection, pattern recognition, and predictive capacities, while metacognitive reasoning remains indispensable for contextual interpretation, ethical assessment, and relational management. The institutionalization of this hybrid model, however, entails significant conceptual and operational challenges. Excessive reliance on AI risks reducing strategic reasoning to technocratic and data-driven logics, undermining the deliberative, ethical, and normative dimensions that sustain the democratic legitimacy of lobbying. Conversely, insufficient or delayed adoption of computational tools may limit practitioners' capacity to respond to the temporal acceleration, informational complexity, and multi-actor interdependencies that characterize contemporary policy processes. A balanced integration, therefore, requires a nuanced understanding of the respective roles of human and algorithmic components, acknowledging their complementarities while explicitly recognizing their asymmetries in epistemic, ethical, and relational capacities.

Future research and professional practice should prioritize the development of scientifically grounded governance frameworks regulating the interaction between metacognitive reasoning and AI-based systems. Such frameworks should establish clear ethical guidelines to ensure algorithmic transparency and accountability, design robust methodologies for systematic bias detection and correction, and promote structured capacity-building initiatives aimed at enhancing practitioners' metacognitive competences in critically interpreting and contextualizing AI outputs. Furthermore, interdisciplinary research combining cognitive science, political science, and computational studies is necessary to refine the theoretical and operational understanding of hybrid models, while cross-national comparative studies would allow for the identification of institutional conditions that either facilitate or constrain their applicability. Such comparative approaches would also improve the

external validity and generalization of the proposed framework by considering variations in governance architecture, regulatory traditions, and political cultures.

In conclusion, the scientific analysis presented supports the assertion that the future of lobbying in data-driven governance systems depends on the balanced and normatively informed integration of metacognitive and computational resources. While AI provides the informational and operational infrastructure necessary for dealing with the scale and complexity of contemporary policy environments, it is metacognition that guarantees the reflexive, ethical, and relational depth required for ensuring lobbying that is strategically effective, epistemically robust, and democratically legitimate. The consolidation of this hybrid paradigm thus represents not only a strategic imperative but also a normative commitment to preserving lobbying as a principled and accountable component of democratic governance.

### **Conflict of interest**

The author declares no conflict of interest.

### **Author details**

Maria Cristina Antonucci  
National Research Council of Italy, Rome

\*Address all correspondence to: mariacristina.antonucci@cnr.it

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# Thinking with Machines: Leveraging Artificial Intelligence (AI) to Foster Metacognitive Reading Comprehension

*Kouider Mokhtari and Nirmal Ghimire*

## Abstract

As artificial intelligence (AI) tools become increasingly accessible in classrooms and homes, educators face a critical question: Can AI be used to *enhance* rather than replace deep cognitive and metacognitive engagement with text? In this chapter, we explore how AI technologies such as large language models (LLMs), intelligent tutoring systems, and adaptive reading platforms can support students in developing metacognitive reading comprehension strategies before, during, and after reading. Consistent with our goal of advocating for framing AI as a partner rather than a cognitive shortcut, we examine how students can be taught to think *with* machines, using AI to prompt reflection, monitor understanding, and regulate their reading processes. Drawing on theories of metacognition, self-regulated learning (SRL), and digital literacy, we share practical models and instructional approaches for integrating AI into metacognitive reading instruction. These approaches highlight strategy use in relation to the metacognitive awareness of reading inventories, such as the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSIR), which assesses the awareness and use of global, problem-solving, and support reading strategies. We address both the affordances and limitations of AI, emphasizing ethical use, student agency, and equitable access, and include a set of reflective prompts and a four-point rubric for assessing metacognitive engagement with AI. By positioning AI as a metacognitive partner rather than a passive content provider, we offer a framework for educators seeking to prepare students for responsive, critical, and reflective reading in the age of intelligent technology.

**Keywords:** AI in education, metacognitive awareness of reading strategies, large language models (LLMs), self-regulated learning, digital literacy

## 1. Introduction

A pressing challenge for educators, researchers, and policymakers is to help ensure that AI technologies are used not to replace human thinking but to enhance it. Nowhere is this more important than in reading comprehension, an essential

skill that demands not just word decoding but deep, metacognitive engagement. In this chapter, we explore how AI can be leveraged to support metacognitive reading comprehension, helping students not only read but also think about and regulate how they make sense of what they read.

Consistent with the extant literature, we define metacognition as the capacity to plan, monitor, and evaluate one's understanding. For K-12 teachers, fostering this awareness in students has long been a central goal of reading instruction. For researchers, metacognitive development represents a rich area of inquiry at the intersection of cognitive science and education. For policymakers, it is an outcome tied to broader goals around digital literacy, critical thinking, and lifelong learning. As digital tools increasingly mediate students' learning experiences, it is therefore critical to consider how educators can ensure that AI supports these goals rather than undermines them.

In this chapter, we advocate for a significant shift in how AI can be integrated into literacy education, moving from a content-delivery tool to a metacognitive partner. We believe that, by leveraging large language models, adaptive reading platforms, and intelligent tutoring systems, educators can use AI to design instruction that actively engages students in reflective thinking, uncovers areas of confusion, and guides them in regulating their reading processes. Rather than functioning as a shortcut, these AI tools can uncover the often-unseen cognitive processes involved in reading. This approach offers students valuable opportunities to develop and refine metacognitive reading strategies, including those assessed by the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSIR) across its global, problem-solving, and support reading strategy categories. Recent randomized studies of AI-supported dialogic reading and feedback report measurable gains in comprehension and reflection when AI is used as a scaffold, not a shortcut.

Drawing on current research in metacognition, self-regulated learning, and digital pedagogy, we outline instructional strategies and system-level considerations for integrating AI into reading instruction. We offer practical models for classroom use, guidance for research design, and key policy implications around equity, access, and ethical use. We also introduce two classroom-ready artifacts, a set of reflective prompts and a concise four-point rubric for assessing metacognitive engagement with AI, to support implementation at scale. By leveraging human agency and reflective thinking, we address the critical question of *how to teach students to think with machines, not just through them*.

To illustrate these principles, we present a classroom-based example using the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSIR). This scenario demonstrates how AI can scaffold students' awareness and use of metacognitive reading comprehension strategies in high school and college classrooms. Specifically, it shows how AI tools can support students in monitoring their focus, regulating their comprehension, and responding proactively to textual challenges.

## **2. The interrelated role of metacognition, self-regulated learning, and digital literacy constructs**

The construct of metacognition, often described as “thinking about thinking,” refers to learners' awareness and regulation or control of their cognitive processes [1–3]. It includes skills such as goal setting, comprehension monitoring, and strategy adjustment, which are critical capacities for navigating complex texts and

digital platforms. These strategies are commonly assessed with instruments like the MARS-R [4, 5].

The construct of self-regulated learning (SRL) builds on metacognitive theory, emphasizing learners' ability to set goals, manage time and resources, and reflect on their learning outcomes [6–8]. SRL is particularly relevant when reading in digital contexts, where students must independently manage distractions, track their progress, and adapt strategies to shifting tasks. AI scaffolding can support these processes by prompting reflection and strategy use [9–11].

The construct of digital literacy encompasses the technical, cognitive, and socio-cultural skills required to effectively locate, evaluate, and use digital information [12, 13] to promote and support learning. Digital literacy includes not only the functional ability to use digital tools but also critical evaluation, ethical participation, and multimodal comprehension. In these areas, AI can enhance evidence-based practices when thoughtfully designed and effectively guided [14].

Together, these theoretical frameworks shed light on how readers actively plan, monitor, and evaluate their engagement with digital texts. They provide a foundation for designing AI tools that do more than deliver content: When positioned as scaffolds, they can simulate dialogic interactions, surface confusion, and strengthen strategic reading [11, 15, 16]. At the same time, emerging work cautions that current large language models (LLMs) lack robust metacognitive capabilities, underscoring the need for human- and strategy-centered design [17]. Anchoring AI integration in these constructs ensures that educational technologies promote not only comprehension but also deeper, transferable thinking skills.

### **3. Affordances and limitations of AI in literacy education**

As AI becomes more embedded in educational technologies, its impact on students' reading behaviors requires careful examination. AI offers several pedagogical advantages, including real-time feedback, adaptive scaffolding, and data-driven instruction. Randomized studies now indicate that AI-generated feedback can improve students' revision performance, motivation, and positive emotions; it can also complement teacher feedback while scaling support [14]. Real-time reflection support can also be delivered at scale: LLM-guided reflection performed on par with structured questionnaire prompts and outperformed slide review in field experiments, highlighting AI's potential to strengthen metacognitive practices [10]. Adaptive systems, such as intelligent tutoring programs, can scaffold self-regulated learning and make learners' cognitive and motivational processes more visible, an area where multimodal traces and pedagogical agents have shown value [9]. Moreover, AI-supported dialogic reading can enhance comprehension in some settings and, in recent randomized controlled trials (RCTs), perform comparably to human partners when used as a scaffold [15, 16]. These affordances align with earlier work on adaptive support and learning analytics [18–20].

However, there are also important drawbacks and design cautions. One concern is privacy: AI tools that track students' progress can raise ethical questions about surveillance and how it might affect students' independence and mental health [21]. Additionally, if students become overly dependent on AI tools, their engagement in critical thinking and the development of self-management [22] skills may be diminished. Technically, today's LLMs also lack robust metacognitive self-monitoring and can be overconfident, failing to recognize knowledge gaps, a limitation that

underscores the need for human oversight and strategy-centered design [17]. Moreover, effects can be conditional: Dialogic-reading gains may depend on learner characteristics such as language proficiency [15], and some implementations primarily boost motivation and engagement without immediate performance gains unless paired with explicit strategy training [11].

To address these challenges, experts suggest that AI systems be designed around human-centered, equity-driven teaching values. In practice, this means creating transparent, accountable, and inclusive tools that position AI as a scaffold for strategic reading (not a shortcut), prompt reflection at key moments, and build AI literacy so learners can engage critically and effectively with the technology [10, 11, 23]. When implemented this way, for example, with adaptive prompts, pedagogical agents, and clear data protection, AI can help students become active, reflective readers while protecting their privacy and independence [9, 14].

#### **4. Using AI to support metacognitive awareness of reading strategies instruction**

To demonstrate the practical application of these concepts, this section presents an instructional model using the Metacognitive Awareness of Reading Strategies Inventory-Revised (MARSIR). We situate a scenario in a high school or college classroom to illustrate how AI tools can prompt and reinforce key metacognitive strategies such as monitoring comprehension, regulating attention, and reflecting on textual engagement. The scenario underscores how AI should function not as a substitute for cognitive effort, but as a scaffold that supports the development of self-directed, metacognitive readers.

##### **4.1 Instructional model (plan → monitor → evaluate) with AI supports**

Effective classroom integration of AI for metacognitive reading development can follow a three-phase cycle long used in self-regulated learning research and in intelligent tutoring systems such as MetaTutor [9].

*Plan.* Begin units by administering MARSIR to identify students' reading strategies and set targets. Use the provided scoring benchmarks (High  $\geq 3.5$ ; Medium 2.5–3.4; Low  $\leq 2.4$ ) to group and personalize instruction [24]. Where possible, combine subscale diagnostics with known students' strengths and needs to capture overall readiness.

*Monitor.* During reading, prompt students (or an AI assistant) to monitor comprehension and articulate repair strategies; randomized field experiments show LLM-aided reflection prompts can raise the quality of self-reflection [10]. For younger learners, chatbot-mediated dialogic reading can nudge comprehension and learning mindset when prompts follow evidence-based dialogic moves [15]. Emphasize specific strategies validated by large-scale programme for international student assessment (PISA) analysis, such as underlining main ideas, checking summaries, verifying information, and discussing texts. These strategies consistently correlate with improved metacognitive skills across diverse learners and contexts [5].

*Evaluate.* After reading, have students evaluate their understanding and next steps. SRL tutors like MetaTutor illustrate how data-driven “nudges” can scaffold these self-evaluations [9]. For multilingual contexts, Pan et al. [11] emphasize using structured evaluation prompts such as summarizing, checking source credibility, and

confidence rating to help learners reflect explicitly on their reading outcomes and readiness to transfer strategies. Throughout this process, it is critical to recognize that current LLMs lack genuine metacognitive abilities; therefore, teacher oversight and transparent criteria are essential [17].

## **4.2 Positioning AI as a scaffold for metacognitive reading strategies instruction**

Rather than acting as a passive content provider, well-designed AI tools can scaffold students' metacognitive awareness as they engage in reading complex texts. When thoughtfully integrated into instruction, AI becomes a dialogic partner, one that helps students externalize their thinking, monitor their understanding, and regulate their approach to challenging reading tasks.

In the following section, we illustrate how educators can leverage AI to activate key metacognitive strategies aligned with the MARS-R inventory [25], organized into three main domains: global reading strategies (GRSs), problem-solving strategies (PSSs), and support reading strategies (SRSs).

## **4.3 Global reading strategies (GRSs): Planning and goal setting with AI**

Before engaging with academic texts, skilled readers often plan their approach by previewing content, setting goals, and activating prior knowledge. AI can support these global strategies by functioning as a cognitive priming agent. In the following sample activity, high school or college students are prompted to co-construct a reading plan before beginning to read an assigned article or chapter on climate policy. By using generative AI tools such as ChatGPT-5, Claude 4, Google Gemini, and Microsoft 365 Copilot, students can enter a prompt such as the following:

### *4.3.1 AI prompt*

"I'm about to read an article about climate policy. Help me plan how to read it effectively. Ask me one clarifying question first, then propose a brief plan I can follow in under 5 minutes. What should I pay attention to? What background knowledge might be helpful? Please format your response with headings and bullet points."

### *4.3.2 Example of a basic AI response*

- a. Clarifying question: What specific aspect of climate policy interests you most (e.g., economic impacts, international agreements, technological solutions)?
- b. Reading goal: Understand how climate policy differs across regions and why.
- c. Prior knowledge check: What do I already know about climate legislation? What terms do I need defined before I start?
- d. Plan of approach: Skim for structure; preview figures/tables; slow down for complex sections (methods, data); annotate claims and evidence.

Students can then reflect on which parts of the plan they found most helpful and revise their goals as needed. An instructor could also prompt the AI for a more detailed response, which might include the following components:

#### *4.3.3 Example of a detailed AI response*

##### *Understand the structure*

- a. *Title*: Indicates the article's specific focus.
- b. *Introduction*: Identifies the article's main argument or thesis.
- c. *Subheadings*: Outline the argument and guide navigation through the text.

##### *Key points to focus on*

- a. *Policy goals*: What is the policy trying to achieve?
- b. *Strategies*: What measures are being proposed (e.g., carbon taxes, renewable energy)?
- c. *Stakeholders*: Who are the main players (governments, businesses, NGOs)?
- d. *Challenges*: What obstacles are mentioned (political, economic, feasibility)?
- e. *Evidence*: Are there case studies or examples? How are they used?

##### *Broader context*

- a. *Current climate crisis*: Understand the urgency of climate change.
- b. *International agreements*: Familiarity with global frameworks like the Paris Agreement.
- c. *Economic/social factors*: Be aware of how climate policy impacts jobs, economies, and social justice.

##### *Critical thinking prompts*

- a. *Bias/perspective*: Be aware of the author's viewpoint and biases.
- b. *Implications*: Think about the short- and long-term impact of policies.

##### *Background knowledge (if needed)*

- a. *Climate science*: Know core terms like emissions and global warming.
- b. *Global climate policy*: How different countries approach regulation.
- c. *Economics of climate change*: Understand concepts like carbon pricing and subsidies.

By engaging in this pre-reading thinking process, students clarify their reading intentions and take ownership of their approach, which are essential elements of metacognitive control in the global reading strategies (GRSs) domain.

#### **4.4 Problem-solving strategies (PSSs): Monitoring comprehension with AI**

Strategic readers monitor their understanding and apply flexible strategies to resolve comprehension breakdowns. However, while reading complex academic texts, most students frequently encounter moments of confusion or ambiguity. Throughout this process, AI tools can assist by serving as a cognitive sounding board, helping students resolve confusion, reprocess information, and test emerging interpretations.

In the following high school or early college reading activity, students are assigned a challenging passage from *The Federalist Papers* or a theoretical sociology text. As they read, they pause at a confusing section and articulate their point of confusion:

##### *4.4.1 Student prompt: Identifying the confusion*

“I’m not sure what Madison means by ‘the multiplicity of interests.’ I think it relates to factions, but I’m unclear on the distinction he’s making.”

Students then copy the passage into the AI and prompt it with a metacognitive task:

##### *4.4.2 Student prompt: Requesting a scaffold, not an answer*

“I’m struggling to understand this paragraph.

- a. Explain it in simpler terms using only the quoted text.
- b. Ask me one question to check my understanding.
- c. Suggest two ‘fix-up’ strategies I can try (e.g., paraphrase a sentence, trace key terms) and tell me what to look for in the text.”

##### *4.4.3 Illustrative AI response*

- a. Simplified restatement: In a large republic, there are many groups with different interests; because no single group dominates everywhere, it is harder for the majority to oppress others.
- b. Comprehension Check: If many interests exist across a large republic, what effect does that have on stable majority rule?
- c. Fix-up strategies: (i) Paraphrase the sentence that mentions “faction” and “majority” in your own words. (ii) Trace referents: Identify what “they” and “those” refer to in the final two sentences.

Students answer the comprehension-check question, apply one fix-up strategy, and note how the exchange clarified their confusion. If uncertainty remains, they can ask targeted follow-ups, such as “Break the longest sentences into clauses and label each clause’s role,” or “List the author’s assumptions vs. claims.”

##### *4.4.4 Optional follow-up prompts*

- “Highlight the phrase that most supports your explanation.”
- “Offer a concrete example or analogy consistent with the paragraph.”

- “Create a two-column table: author’s claim vs. evidence cited.”
- “Identify any counterclaim or limitation implied by the author.”

#### *4.4.5 Quick reflection*

- What specific misunderstanding did I resolve?
- Which strategy was most helpful (paraphrasing, tracing referents, chunking sentences, using an example)?
- What textual evidence confirms my new understanding?
- What question do I still have for discussion?

This activity enhances students’ ability to monitor comprehension, self-correct, and persist through challenges using problem-solving strategies in the metacognitive reading strategies such as those outlined in the MARSII-R inventory. Moreover, it keeps agency with the reader by requiring evidence from the text and a response to the AI’s check question before proceeding.

### **4.5 Support reading strategies (SRSs): Summarizing and evaluating understanding with AI**

After completing assigned academic texts, metacognitive readers often synthesize key ideas, evaluate their understanding, and connect new learning to prior knowledge. AI can play an evaluative role in this stage by offering feedback on student-generated summaries and facilitating comparison. In the following example, situated in a first-year writing or introductory humanities course, students read an academic article and draft a one-paragraph summary in their own words. After drafting an initial summary, they engage with AI using a prompt such as the following:

#### *4.5.1 Student prompt: Requesting comparative feedback*

“Here is my summary of the article (pasted below). Please generate a concise summary based only on the excerpt I provide, then list 2–3 key ideas you think a strong summary should include. After that, ask me one question to check my understanding.”

#### *4.5.2 AI response with student dialog (illustrative)*

The AI produces a concise summary, often with slightly different emphases, and follows with a brief checklist and a single comprehension check. Students then engage in self-reflection by considering these questions:

- What did the AI-generated summary include that I left out?
- Are there any misconceptions in my summary?
- What do the differences between the two summaries suggest about my comprehension of the text?

Students revise their summary, answer the AI's comprehension-check question, and, if needed, ask for a more detailed comparison (e.g., "Create a two-column table comparing the claims in my summary to the claims in yours, and flag any evidence from the text that I should consider adding").

This comparative process encourages evaluation and revision, helping students refine understanding while developing summary and paraphrasing skills. To maintain agency and prevent AI hallucinations, instructors should remind students to paste only text they are allowed to share and to direct AI to base its feedback strictly on the provided excerpt.

#### *4.5.3 Optional extensions*

- Request quote identification: "Highlight two short phrases from the excerpt that support the main claim."
- Ask for a "Gist" test: "Compress both summaries into one 15-word sentence and then compare them."
- Request a rubric-based evaluation: "Rate my summary on a four-point rubric (clarity, accuracy, concision, coverage) and justify each score in one sentence."

#### *4.5.4 Promoting reflective dialog with AI*

Across all three strategy domains (i.e., global, problem-solving, and support reading strategies), the key instructional approach is positioning AI not as an expert but as a reflective partner that prompts deeper cognitive engagement. We encourage literacy educators to help students interrogate AI outputs with questions such as:

- Does this AI-generated response align with my understanding of the text?
- What new questions does this response raise for me?
- Should I accept this response, revise it, or challenge it, and why?

By doing so, students move beyond passive reception and adopt the role of active, agentive readers and thinkers. They learn to use AI not to shortcut cognition but to extend and deepen it. As metacognitive skills develop, so too does students' ability to use AI ethically and strategically—skills that are essential in both academic and real-world contexts.

## **5. Assessing metacognitive engagement when students use AI**

When assessing metacognitive engagement, we present two options: (a) a set of reflective prompts aligned with each metacognitive strategy domain and (b) a concise rubric for evaluating metacognitive engagement with AI.

### **5.1 Reflective prompts**

The following student prompts are designed to be used after a reading activity in which students engaged with AI as a metacognitive partner. These prompts

are designed to target key aspects of metacognitive awareness including planning, monitoring, evaluating, and regulating strategies before, during, and after reading. Literacy educators can incorporate these prompts into journals, discussion boards, and/or AI chat threads. For practical implementation, we suggest assigning one to two prompts per domain; brief (three- to five-sentence) responses are appropriate.

#### *5.1.1 Global reading strategies (before reading)*

- “How did you plan your approach to reading? Did the AI help you set specific goals or activate prior knowledge?”
- “What predictions or questions did you generate before reading, and how did they shape your approach?”

#### *5.1.2 Problem-solving strategies (during reading)*

- “Describe a moment when you were confused while reading. How did you try to resolve it, and how (if at all) did the AI assist you?”
- “Did the AI’s responses challenge or confirm your interpretation of the text? How did you decide whether to trust it?”

#### *5.1.3 Support strategies (after reading)*

- “Compare your understanding of the text before and after using the AI. What changed, and why?”
- “How did engaging with the AI help you summarize or synthesize key ideas from the text?”

#### *5.1.4 General reflective prompts*

- “What did you learn about your own thinking from this reading activity?”
- “What specific reading strategies did you use, and how did AI help or hinder them?”
- “What will you do differently next time you read with an AI companion?”

### **5.2 Rubric for assessing metacognitive engagement with AI**

This four-point rubric is designed to assess students’ metacognitive engagement with AI. It can be adapted for written reflections, journals, discussion posts, or oral discussions or reviews. For *scoring, each dimension can be rated on a scale of one to four, with the mean score representing overall performance. We recommend encouraging students to support their reflections with brief, text-grounded evidence* (see **Table 1**).

### **5.3 Sample assignment using reflective prompts and rubric**

After using AI to analyze a complex academic text, students submit an approximately 200-word reflection responding to three of the five reflective prompts from

| Dimension                 | 4 - Highly metacognitive                                                                                                                                           | 3 - Moderate                                                                              | 2 - Emerging                                                                       | 1 - Limited                                             |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------|
| Awareness of strategy use | Explicitly identifies and justifies multiple reading strategies (e.g., summarizing, clarifying, questioning); connects strategy use to specific parts of the text. | Identifies some strategies and attempts to explain their use.                             | Names strategies with minimal explanation or weak connections to the text.         | Does not identify or reflect on strategy use.           |
| Monitoring and regulation | Clearly demonstrates awareness of confusion or misinterpretation or explains its resolution—with and without AI—including at least one fix-up strategy.            | Mentions comprehension challenges and partial attempts to resolve them.                   | Identifies difficulty but lacks clarity on how it was addressed.                   | No evidence of monitoring or self-regulation.           |
| Critical use of AI        | Engages dialogically with AI: asks follow-up questions, compares responses to the text, and critiques or refines AI output with justification.                     | Uses AI to support understanding with some reflection or comparison.                      | Uses AI in a basic or passive way (e.g., copy/paste answers) with little critique. | No AI engagement or uncritical acceptance of AI output. |
| Reflection and transfer   | Reflects deeply on how AI interaction shaped comprehension and names concrete next steps for applying strategies in future contexts.                               | Reflects on AI's role in the current task but with limited connection to future learning. | Offers vague reflection, little evidence of intended transfer.                     | No reflection or evidence of learning transfer.         |

**Table 1.**  
*Rubric for evaluating students' metacognitive engagement with artificial intelligence.*

Section 5.1, ensuring at least two different domains are represented. Student sub-missions are then evaluated using the rubric above. Scoring can take several forms, including points-based grading, brief descriptive feedback, or structured self-assessment using the same rubric.

*Submission checklist:*

- Cite the assigned text (page or paragraph number) to support at least one claim.
- Include key excerpts from your AI exchange (or a brief summary of the interaction).
- Conclude with one specific “next step” you will try in your next reading activity involving an AI partner.

## 6. Implications for teachers, researchers, and policymakers

Unlocking the transformative potential of AI in literacy education requires alignment among instructional practices, empirical research, and educational policy. Building on this chapter's findings, we outline targeted implications for each stakeholder group.

*For educators.* Incorporate AI as a metacognitive tool by designing activities in which AI serves as a reflective partner, prompting students to examine their process and deepen understanding. Provide explicit scaffolds for AI use, such as plan→monitor→evaluate prompts, text-grounded justification, and brief self-checks—so students learn to question, evaluate, and, when appropriate, challenge AI outputs. Use quick, low-stakes artifacts and a concise four-point rubric to track growth in planning, monitoring, evaluation, and transfer.

*For researchers.* Investigate AI's impact on reading comprehension and metacognition across contexts and learner profiles, with attention to how AI influences students' ability to monitor, regulate, and improve their reading comprehension over time. Prioritize designs that test strategy scaffolds (not just content delivery), examine long-term outcomes such as agency and calibration, and use valid, transparent measures of metacognitive engagement. When possible, report implementation details to support replication and build a cumulative evidence base.

*For policymakers.* Promote equitable access to high-quality AI tools and the infrastructure (e.g., devices, bandwidth, and teacher professional learning) required for effective integration. Establish clear, enforceable guidelines for privacy, bias mitigation, transparency, and data minimization, along with procurement standards that require human-in-the-loop oversight, audit rights, and accessible documentation for educators and families.

## **7. Conclusion**

AI technologies are increasingly integrated into educational contexts, prompting important questions about their role in supporting deep cognitive and metacognitive engagement with reading. This chapter argues for using AI as a scaffold, not a shortcut: a dialogic partner that helps students plan, monitor, and evaluate their reading, rather than a passive content provider. We have presented theoretical foundations, an instructional model aligned with MARSİ-R strategy domains, and practical resources (reflective prompts and a concise four-point rubric) to help educators implement these ideas. With research that foregrounds metacognitive processes and policy that safeguards privacy, equity, and transparency, teachers, researchers, and policymakers can work together to help students think with machines, not just through them, building durable, transferable reading strategies for academic and real-world contexts.

## **Conflict of interest**

The authors declare no conflict of interest.

## Author details

Kouider Mokhtari<sup>1\*</sup> and Nirmal Ghimire<sup>2</sup>

1 The University of Texas at Tyler, Tyler, TX, United States

2 The University of North Carolina, Wilmington, NC, United States

\*Address all correspondence to: [kmokhtari@uttyler.edu](mailto:kmokhtari@uttyler.edu)

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## Section 2

# Metacognition for Mental Well-Being and Self-Regulation

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# Perspective Chapter: Metacognitive Insight and the Serenity Barometer – Calm Vs. Imperative Mental Processing

*Renate Kosuch*

## Abstract

While mental self-regulation in challenging situations can be successful in a state of calmness, it is limited under conditions of high arousal. A high psychotone, which is associated with mental tension and lack of serenity, is an obstacle to acceptance of the unchangeable and limits the possibility of making full use of one's own scope for action. Recognizing the different mental processing modalities – calmly stating vs. imperative intervening – can be helpful in such situations. The Serenity Barometer, based on Introvision as a theory and method for promoting serenity, serves as a self-assessment tool for these mental processes. This ensures that “thinking about thinking” does not lead to even more inner conflicts. In addition, the Serenity Barometer might help to regulate situational serenity. This chapter is intended for coaches who are interested in the theoretical background of the development of this self-reflection tool. They may also consider adding it to their toolkit and reflecting on their personal serenity in coaching.

**Keywords:** fostering serenity, metacognitive knowledge, mental self-regulation, introvision, self-reflection tool, coaching

## 1. Introduction

Metacognitive strategies play an important role in learning but it is also suggested to help control feelings and actions. Scholten emphasizes that metacognition is crucial because it helps to manage one's mind efficiently, allowing for full control over thoughts and beliefs [1]. Metacognition is described to involve two key aspects: metacognitive knowledge, which is the awareness of one's cognitive activities, and metacognitive control, the regulation of these processes: “This ‘thinking about thinking’ is assumed to be somewhat divided into two parts” [1]. Drigas et al., for example, emphasizing metacognition as a key competence in the present era, identified eight basic pillars of metacognition [2]. The first pillar is “Deep theoretical knowledge on our cognition, in general, and our cognitive functions, in particular.” Building on this, understanding the operational aspects of these functions, including their capacities and limitations, is essential for effective management and utilization. In addition, the

ability to monitor and evaluate one's physical, cognitive, and emotional states in real time enhances self-awareness and regulation [2]. According to the authors, this self-monitoring requires cognitive flexibility. While this aspect of metacognition is viewed positively in this context, the inherent inability to choose against the spontaneous thought processes of the mind is often seen in a negative light [2].

This very experience of not being able to fully control the movements of one's consciousness served as the starting point for research on Introvision [3]. Attempting to eliminate what is already present in the mind often results in inner conflicts, leading to a loss of serenity. The application of willpower to something that cannot be influenced by willpower leads to a high psychotone and loss of serenity instead of fostering full control over thoughts – especially in emotionally charged situations ([3], pp. 17–33).

To be able to experience, decide, and act more calmly is the goal of the counseling, coaching, and self-help method “Introvision”, which was developed in a long-term research program under the direction of Prof. Dr. Angelika Wagner at the University of Hamburg [3]. The results of a large DFG (German Research Foundation) study on strategies of professional action had shown how often thoughts circle unproductively and the associated processes deviate from known models of action regulation [4]. They were labeled as “knots in thinking” [5–7]. Initially, the ultimate goal was to find ways to improve learning and teaching. Those unexpected results occurred when analyzing data from stimulated recall (retrospective thinking aloud). Both teachers' and students' cognitions became entangled during instruction and impeded learning processes [4, 5]. Findings showed that internal conflicts and the efforts to control them hinder teaching and learning. This initially led to the theory of subjective imperatives, which can show two modalities of processing – imperative and non-imperative thinking [4, 5].

Imperatives are cognitive and emotional directives that feel urgent and compelling, similar to sentences with exclamation marks, such as “X MUST happen!” or “X MUST NOT happen!” [5]. They often come with strong emotions, such as anger or fear. Even when a person is consciously aware that these emotions may be exaggerated, a sense of urgency remains. This is because imperatives act as internal commands that clash with a person's conscious thoughts, creating an inner conflict. For instance, when someone tells themselves “X MUST NOT happen!,” their consciousness tries to reject X, even though X is already part of their thoughts. Thus, consciousness attempts to erase what is already there, leading to tension and confusion [5].

To resolve one's conflicts can enhance information processing and thus improve not only learning situations but also problem-solving. Furthermore, it can promote general well-being.

Therefore, extensive empirical studies were conducted on the emergence, structure, and resolution of mental conflicts and the analysis of core conflicts ([3], pp. 43–50). In 1985, Wagner founded the “Mental Self-Regulation” research group. For an overview of the structure of the research program, see [3]. In addition, Wagner has developed a fundamental theory of the emergence and resolution of internal conflicts by intervening in one's own information processing – the theory of mental interference (TMI) ([3], pp. 43–50; [8]). An English explanation can be found in an article by Klebanova [9]. This theory explains the four-step process to manage and resolve interference caused by current cognitive content. A process is described where default cognition (such as a contradictory or overwhelming thought, see 2.) is addressed by suppressing it and inscribing a self-directed imperative, with the ultimate goal of managing the interference. Additionally, the theory also explores an alternative resolution process through the “epistemic system,” in a calm way of facing what is.

Designed to help people overcome internal conflicts and mental obstacles, it allows individuals to find calm and mental clarity in challenging situations. The approach is based on the idea that inner turmoil stems from cognitive-affective interference, which occurs when thoughts are mixed with heightened arousal, tension, and inhibition. Introvision resolves these interferences in two steps.

First, the underlying conflict is pinpointed using a method based on the theory of subjective imperatives. Second, the individual focuses their attention on the thought without trying to change it. Thereby Introvision aims to separate the emotional charge from the subcognition of the core imperative. This is achieved through a technique called “stated attentive perception” (SAP), developed by Wagner et al. [3]. This technique involves “awareness of what is,” which aims to eliminate the automatic mental interference associated with the thought. Typically, this method requires several weeks of practice before it is effective in resolving inner conflicts.

Evidence for SAP technique helping to detach the subcognition from its emotional charge is available from over 60 empirical studies on the structure of conflict and the effectiveness of Introvision [3] – for reviews in English, see [9, 10]. The results show that the use of Introvision in counseling, coaching, and as a self-help method may lead to significant positive changes in the way people experience and deal with conflicts ([3], pp. 43–50).

As part of this scientifically based method of mental self-regulation, the Serenity Barometer was developed by the author in 2018 ([3], pp. 185–191; [11]). It is designed to help individuals enhance their metacognitive awareness by not only better perceiving mental tension but also understanding and regulating the mental processes that lead to a loss of composure. This tool can therefore be used not only without being an expert in Introvision but also as a precursor to it, and in contexts such as further education, training, and applied research.

The Serenity Barometer, which highlights the different aspects of experiencing serenity and its loss, is aimed at coaches. It identifies potential pitfalls in coaching processes that focus on self-change and coping. In such contexts, coachees may unintentionally increase stress and pressure by imposing their desired goals on their consciousness, which can ultimately prevent change. Furthermore, coaches may unintentionally pressure coachees to change because they may not fully understand the cognitive processes that contribute to losing serenity [12].

Developing metacognitive awareness is crucial in taking the first step toward resolving internal conflicts. In conclusion, the structure of the book’s chapters is outlined as follows: In Chapter 2, the discussion moves on from the theoretical underpinnings of Introvision and serenity to the impact of serenity on mental processes. This exploration is viewed through the lens of this theory of mental self-regulation. Chapter 3 focuses on how the Serenity Barometer enhances metacognitive knowledge, improving the ability to maintain or restore calmness. Chapter 4 details the development and structure of the Serenity Barometer, presenting its components and applications. Finally, in Chapter 5, the findings from practical applications and user experiences are briefly touched, and consideration is given to the tool’s effectiveness in different contexts.

## **2. The role of serenity, and the loss of serenity, in self-regulation**

Serenity is defined as “a state of inner peace, associated with a feeling of effortlessness and well-being, and the absence of conflicts in conscious mental processes

(thoughts, feelings, sensations)” ([3], p. 24). With serenity, one can “plan, wish, act, invent, infer, feel, enjoy, dream” ([3], p. 73). According to the underlying theory of mental self-regulation, the absence of inner conflicts is a central aspect. This is particularly relevant when challenges lead to inner conflict.

Striving for more serenity, as defined above, is possible without forcing oneself into stress-inducing self-optimization. Fundamentally altering one’s nature is not required. Whether one is quick or slow, expressive or reserved is irrelevant to preserving serenity. From this perspective, serenity is not a permanent trait, but rather a skill that allows one to return to a state of calm. This quality can be developed through Introvision training and application [11]. Understanding the mental processes associated with the loss of serenity is a crucial step ([11], p. 19).

### 2.1 The psychotone scale and the modalities of processing

The Serenity Barometer is introduced as a self-reflection tool to enhance awareness of processes that steal or promote serenity. This concept of serenity finds an optimal level of mental tension in everyday understanding, as demonstrated by Wagner’s Psychotone Scale (Level 4, see **Table 1**).

This scale helps us understand that achieving a practical level of serenity that can be easily applied in everyday situations is an appropriate goal. Essentially, the aim is to make it suitable for everyday life. Serenity is often mistaken for the deep serenity of meditation and therefore can be undervalued as undesirable for challenging situations. The Serenity Barometer therefore aids in distinguishing between Level 4 (acting without noticeable resistance) and Level 5 (acting against internal resistance).

**Table 2** compares these two qualities – modalities of mental functioning – focusing on the differences at the interface between psychotonic levels 4 and 5. The aspects enumerated there form the basis for the development of the self-reflection items (see 4.). On the left, the table highlights the ability to acknowledge or state facts or realities in a calm and composed manner, which is indicative of a balanced psychological state. On the right, it implies exerting control or influence while experiencing a sense of strain or stress, indicating a more intense psychological state.

The difference between feelings and affects, within this mental self-regulation framework, is noteworthy. Feeling with serenity means perceiving as they arise without judgment or immediate change, which helps in identifying and classifying different states rapidly ([3], p. 278, p. 193).

| Psychotone scale |                                                                                        |
|------------------|----------------------------------------------------------------------------------------|
| 7                | Escalating acute conflict (panic, despair, blackout)                                   |
| 6                | Acute conflict (anxiety, decision-making dilemma, anger, depression)                   |
| 5                | Effort, volition (self-command, impulsivity, self-mastery)                             |
| 4                | Daily routine consciousness (wakefulness, deliberate acts without sensible resistance) |
| 3                | Incipient relaxation (decreasing arousal, lack of active volition processes)           |
| 2                | Absorption, flow experience (oneness, inner clarity, trance)                           |
| 1                | Absolute serenity (timelessness, egolessness, emptiness)                               |

*According to Wagner et al., translated by Klebanova ([9], p. 10).*

**Table 1.**  
*The psychotone scale.*

| to calmly state what is (see Level 4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | to impose imperatives on oneself (see Level 5)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Self-communication and self-perception (see first and second aspect in the Serenity Barometer)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>In serenity:</i><br>= to acknowledge, to recognize what is:<br><br><i>Accepting:</i> “That’s how it is.” (Associated thoughts and feelings, even unpleasant ones, do not need to be pushed away and will subside.)                                                                                                                                                                                                                                                                                                                               | <i>in self-alarm, as an imperative:</i><br>= wanting it to be different at all costs, to intervene in what is:<br><br><i>not accepting:</i> “This must not be!” (Trying to get rid of the unpleasant feelings associated, but as the discomfort has already occurred or may occur, the thoughts go round in circles).                                                                                                                                                                                                                                                                                                     |
| Basic attitude / basic feeling (see third aspect in the Serenity Barometer)                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| “I will ...” (mentally, this attitude is perceived as rather expansive or open)<br>“ <i>Vision</i> ” (“This will be so ... or otherwise.”)<br><br>Quality of experience in terms of serenity:<br>“Maintaining serenity is possible.”<br>(Psychotonic level is rather low, <i>feelings</i> )<br>Calm feelings                                                                                                                                                                                                                                        | “I must ...!” (mentally, this attitude is perceived as rather narrow or constricting)<br>“ <i>Mission</i> ” (“It absolutely has to be this way and in no other way!”)<br><br>Quality of experience in terms of serenity:<br>“I must become calmer!”<br>(Psychotonic level is rather high, <i>affects</i> )<br>Overwhelming or inhibited feelings                                                                                                                                                                                                                                                                          |
| Capacity for action in the face of limitations on influence (see fourth and fifth aspect in the Serenity Barometer)                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Challenging situation or social conflict</i><br>With broadly focused attention, stay with what is<br><br>= few or no internal conflicts activated<br><i>effortlessness</i><br><i>Large scope of action</i> – “What needs to be done?”<br><br><i>Act without any noticeable internal resistance</i><br><i>mentally expansive</i> (“open mind”)<br><i>accepting the discomfort and allow it to subside</i> (let go)<br><br><i>Mental resources are thus free to activate problem-solving processes, including access to experience, tools, ...</i> | <i>Challenging situation or social conflict</i><br>Activation of the belief that something absolutely has to be or must not be<br>= internal conflicts are significantly activated<br><i>tension, (persistent) stress</i><br><i>Limited scope of action</i> – many possible actions do not come to mind.<br><br><i>Acting against inner resistance</i><br><i>mentally constricted, with tunnel vision,</i><br><i>wanting to get rid of the unpleasant</i> (thoughts going in circles, knots)<br><br><i>Mental resources are therefore tied up by the activation of coping strategies that involve conflict avoidance.</i> |
| Source: ([12], pp. 533–534).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

**Table 2.**  
 Two modalities of mental processing: stating calmly (acknowledging the possibility of occurrence) vs. imperative intervening (intervening in one’s own information processing in a commanding, imperative way).

## 2.2 The theory of mental interference

The loss of serenity originally is meant to serve as an emergency response in unsolvable conflicts, such as:

- **CONTRADICTION:** A or B, but not both – defend or flee.
- **DISCREPANCY:** Not going as planned – blocked paths.
- **INCONGRUENCE:** Incompatible with reality – misattributed threats.
- **GAP:** Lack of insight – no strategic response available.

Wagner's theory of mental interference [3, 8] outlines "CODING" defaults used in these existential emergencies.

In everyday life – when not in a life-threatening situation – conflict avoidance strategies such as denial, exaggeration, or minimization fill these four gaps. Common expressions such as "overreacting" or "downplaying" demonstrate this intervention. Accepting a situation and dealing with actions without mental resistance often fails. Instead, these reactions lead to increased psychological tension, which manifests itself as agitation or repression. The termination of these so-called interferential interventions can then lead to serenity ([3], p. 35).

Addressing CODING errors outside existential situations demands serenity, as illustrated in the following example [13].

An executive is in the middle of an important contract negotiation and cannot remember the name of the most important customer standing right in front of her. She may be struggling to find her words and becoming noticeably tongue-tied for four reasons (CO-D-IN-G):

1. A mental **contradiction** arises because she remembers two names: "Jackson or Johnson? It cannot be both!"
2. A **discrepancy** exists when the executive feels the name is on the tip of her tongue, but sudden confusion or a mental block prevents her from saying it: "It's not going the way it should!"
3. An **incongruity** occurs when only one wrong name comes to mind: "Jabbar – no, that's not right!"
4. She cannot remember the name at all – there is a **gap**: "I have no idea!"

If she could acknowledge that the name does not immediately come to mind by calmly stating the fact, she would be able to handle the situation calmly. Possibly, this approach might also help her recall the name without interfering in an imperative way. Serenity allows her to retain enough mental capacity to address the issue at hand. Situations like this are often linked to existential inner conflicts, or "core imperatives," such as "It must not be that I am nothing!" These conflicts are linked through chains of imperatives coupled with emotionally charged feelings, which lead to increased tension ([11], pp. 133–138, [14]).

### **3. Strengthening metacognitive knowledge through the serenity barometer**

In counseling or coaching processes focused on self-change and coping, there is a risk that the coachee may impose their desired goals on their own consciousness. This can lead to increased stress and pressure, ultimately blocking the potential for change. An important foundation and training goal in promoting serenity through Introvision is, first and foremost, understanding which mental processes can lead to a loss of serenity ([11], p. 19). Exploring the theory of mental interference can enhance metacognitive knowledge of when and how mental processing is interrupted in ways that create internal conflicts and increase psychotension. Simultaneously, it involves recognizing the difference in perception between experiencing the loss of serenity and

possibly experiencing the same situation in a state of calmness. The Serenity Barometer presented here for self-reflection focuses on these metacognitive processes.

Using metacognitive practices – thinking about thinking – to improve the ability to monitor, reflect on, and regulate one's thinking can lead to insights similar to those Wagner discovered in her extensive research on teaching and learning.

It is suggested that metacognitive awareness enables individuals to step back and reflect on cognitive processes, thereby improving conflict management. By examining thoughts and emotions in interaction with the environment, this approach can enhance the quality of these interactions, leading to mutually beneficial outcomes [15]. Thus, metacognitive strategies are designed to improve self-regulation through reflection on one's thoughts and the creation of mental instructions based on them. However, this approach tends to fail when it is needed most, particularly during periods of anxiety, anger, inner conflict, or mental block. Unpleasant sensations may arise unintentionally and uncontrollably, thoughts may become repetitive, and appropriate responses often do not emerge until the inner turmoil has subsided. Efforts to change – whether by staying calm, reacting more quickly, or breaking a habit – often fall short or become overwhelming. When internal conflicts are triggered, the ability to access and execute one's actions and coping mechanisms, as well as the ability to adopt new, meaningful behaviors, is impaired. The discrepancy between desired and actual behavior can even increase personal pressure, especially when goals are forcefully integrated into one's routine (“I must, from now on...!”). This demanding perspective, which can also be directed at external circumstances (“It can't be true...!”), results in a pervasive state of self-exhaustion that reflects a diminished ability to self-regulate – ironically, at a time when successful self-regulation is more important than ever.

Thus, Introvision may help to understand when and how metacognitive activities promote self-regulation. It emphasizes the importance of the mental modality employed when applying metacognitive skills. Does the individual calmly acknowledge and state what is happening, or do they pressure themselves, causing tension? (see **Table 2**). A detailed exploration of the Serenity Barometer and its development follows.

## **4. Development and structure of the serenity barometer**

The starting point for developing the barometer was that gaining knowledge about mental processes involved in the loss of serenity is already a first step toward fostering serenity ([11], p. 19). Therefore, these processes were theoretically explained in the above sections; however, in the barometer itself, they are described in a way that does not require deep engagement with the underlying concepts. The key elements have been summarized in an information sheet, which is a preliminary guide to the use of the barometer.

### **4.1 The introductory information sheet**

The introduction is designed to help users understand how the Serenity Barometer can be used as a tool for self-reflection and increasing mental serenity.

It highlights the importance of recognizing when and how personal interventions in thoughts and feelings occur that can lead to high levels of mental tension. Using the barometer regularly – the text continues – individuals can become more sensitive to their mental self-regulation processes and gain insight into how they experience and

cope with challenges. The introduction highlights serenity as a mindset of inner calm, mindfulness, and foresight, helping conserve energy by accepting reality and focusing on “what is.” It also clarifies the consequences of losing serenity, such as stress, anger and feelings of helplessness, which can lead to inner conflict. Suppressing these emotions can lead to mental blockages and a tunnel vision effect, limiting options and obscuring possible solutions. It offers practical advice on how to use the barometer to assess mental processes and emotional responses, guiding users toward a calmer and more serene state of mind.

From a metacognitive action perspective, the information provided encourages users to become aware of how they regulate their own mental processes. By being informed about how people often respond to challenging situations, users of the Serenity Barometer are encouraged to engage in the metacognitive activity of self-monitoring. Metacognitive awareness is thus addressed to promote a deeper understanding of how one’s cognitive and emotional patterns affect behavior and to prepare for more conscious and effective management of mental states.

The following section describes the construction process of the Serenity Barometer itself based on Introvision’s Mental Self-Regulation Theory. This process has been carefully designed to accurately capture and reflect the nuances of serenity and its disturbances so that users can usefully assess their inner experiences.

## **4.2 Constructing the barometer**

Building on the following fundamental principles, the Serenity Barometer offers a structured approach for users to engage in reflective practice and deepen their understanding of mental processes. Within this framework, several key components guide the user’s exploration and reflection.

*Contrast assessment:* The barometer is used to assess whether internal experiences in a specific situation are perceived as more serene or less serene. The aim is to increasingly notice this difference. A polarity profile with gradations of agreement to various statements was chosen for this purpose. Another reason for using contrast is that when users see themselves in a description of high psychological tension, it becomes clear what mental processes would look like if they were more serene. So even when they are under high pressure, they will read the opposite modality and understand how the mind can work without intervening in one’s own information processing in an imperative way. With these metacognitive insights, individuals can be more aware of the gap between current and desired states more effectively. Individuals often know how things should not be but may lack a sense of where inner development could lead. By reviewing the items on the barometer and rating the self-completed statements, it becomes clear what is actually experienced and done when serenity is lost or maintained, which can then be reflected upon together in coaching.

*Non-judgmental self-observation:* Another goal in the development process was to provide impulses for self-observation that trigger minimal self-assessment (and thus possible self-condemnation). The process of completing the rating scale and viewing the results should encourage constructive self-reflection. Collectively, assessments of the nature of internal experiences provide a picture of tendencies toward one or the other extreme, without fixing it to a numerical “test result”. A non-judgmental emotional disposition during completion is promoted by ensuring that the opposing statements describe a specific experienced situation (state), rather than invoking an idea of a lasting personality trait. Therefore, it is important to tailor the barometer statements to specific contexts before using it by filling in the text gaps accordingly. This can

pertain to a specific situation, a clearly defined time period, or a recurring specific event that leads to a loss of serenity (e.g., “Every time someone interrupts me, ...”). The five-level scale is designed so that a statement can be considered irrelevant or inaccurate. If so, the middle is checked, and the item does not factor into the evaluation, although it can still be considered during reflection.

*Item development:* When formulating items, it was essential to identify signs that mental (re-)processing promotes serenity. First, a person can distinguish between things that can be changed and those that cannot. Second, this person can accept their (possibly little serene) experiences without overriding them, thereby avoiding tunnel vision and creating space for effortlessly choosing suitable responses.

Key indicators of these aspects include:

1. At the *level of content*, *mental experiences* occur within an accepting attitude, which is reflected in the acknowledgement: “Yes, that’s how he/she is (at the moment).”
2. In the *overall quality of experience*, this is evident in minimal additional intervention. The person seldom becomes additionally (mentally) tense about others’ behavior or specific circumstances. Feelings arise as responses without being intensified (e.g., anger, rage) or blocked (e.g., withdrawal, surrender, experiencing a blackout). Overall, feelings are more apparent than affects (see Section 2). The fundamental tone of experience is acceptance.
3. The *scope of action* is not significantly constrained. The person can access various, including new, possibilities of action. In other words, they are not compelled to react automatically in a certain way, as if on autopilot. Feelings are recognized as feelings that one can follow to derive actions or not.

Subsequently, items were formulated, oriented at the differences between the tense imperative mode and the serene acknowledgment of “what is” at the interface between psychotonic levels 4 and 5 (see **Table 1**). They were categorized along five aspects of mental processing, which are as follows: self-communication, self-awareness, handling one’s feelings and moods, dealing with influence limitations, and the scope of action (see **Table 2**; see the five thematic sections in the Serenity Barometer).

The prototype of the nonspecific Serenity Barometer was first tailored to a specific target group in 2018 by filling out the spaces that serve to make the barometer specific for the user. Results from six group interviews with 51 caregivers of relatives with dementia on serenity were used to linguistically revise the barometer for greater clarity [16].

Finally, the Serenity Barometer was prefaced with instructions explaining its application goals and the concept of serenity. Instructions on its use follow. A subject must first be chosen, deciding whether the assessment pertains to a specific or recurring challenging situation. When reflecting on a specific situation, the tool can be used once. The frequency of use remains at the discretion of those who wish to reflect on their serenity.

### 4.3 Evaluation instructions

The last page of the barometer provides instructions for evaluating the individual assessments as a whole. The first thing that becomes clear is whether promoting

calmness is recommended. In addition, by providing a snapshot of supportive and inhibiting mental processing methods, the tool now offers the opportunity to examine whether non-influential factors can be perceived in a descriptive manner, or if there is a more imperative reaction to situations and emotions.

All of this can be reflected on during coaching sessions. It can be helpful to include the least or not at all selected opposite pole in the reflection. The five thematic sections – self-communication, self-perception, dealing with emotions and moods, and dealing with the limits of influence and scope for action – which mirror the three headlines of the presentation of two modalities of mental processing in **Table 2** can help further structure the process of “thinking about thinking.”

## **5. Application experiences and conclusion**

The Serenity Barometer is designed for self-reflection. After evaluating the individual thematically supplemented items, the evaluation and reflection process can be accompanied in a coaching session. Experiences with this theory-driven reflection tool have so far been collected unsystematically as testimonials. These are mainly from a training seminar on Introvision at the University of Hamburg and an exchange with about 20 coaches in a webinar on the Serenity Barometer.

- ... will use the Serenity Barometer in sleep coaching.
- ... a wonderful tool, practical, and easy to use.
- ... it encourages you to dare to go deeper, it's not a test, there's no right or wrong, it's mainly for self-assessment.
- ... has already somewhat regulated me a little while using it.
- ... a fascinating tool that brings me relief. You realize that the solution orientation often increases the discrepancy between the current state and the desired state—this creates pressure.
- ... the underlying definition of serenity as everyday alertness is very helpful.
- ... double benefit for self-reflection as a coach, and for making coachees aware of his or her mental state ([12], pp. 538–539).

Various reports indicate that coaches who have experimented with the reflection tool themselves find that it allows them to put less pressure on their coaches and to better support their self-acceptance. In addition, the barometer supports a basic attitude of inquisitive interest in oneself and protects against impairing and unrealistic goal setting. Further feedback shows that focusing on a specific context during self-assessment with the Serenity Barometer contributes to better acceptance of emotions and letting go of unhelpful thought processes – true to the essence of serenity. Reflection using the Serenity Barometer also allows conclusions to be drawn about where change is needed or where support should be sought.

Included in the appendix are the self-reflection tool and a sample introductory information sheet. Before using the tool, it is important to fill in the underlined spaces with theme-specific occasions and/or examples.

Further research is needed to fully understand the barometer's significance and impact. It is important to note that the Serenity Barometer is a theoretical reflection tool encompassing five dimensions of experience rather than a test for categorization. Therefore is not subject to quantitative evaluation. The Serenity Barometer and the Psychotone Scale serve distinct yet different purposes in promoting self-awareness through metacognitive engagement. The Psychotone Scale enables users to evaluate and contemplate their level of psychological tension by focusing on quantitative measures (see **Table 1**). In contrast, the Serenity Barometer not only emphasizes qualitative analysis but also incorporates quantitative elements.

The aim of this tool is to make individuals more aware of the processes linked to their internal experiences, helping them to understand the sensations of non-serenity and serenity, as well as the related mental activities. To examine those mental processes, individuals typically employ the Serenity Barometer to specific situations. Self-exploration with the serenity barometer can help individuals to better manage their inner experiences, even if there is no substitute for resolving inner conflicts.

Through a metacognitive lens, by engaging with this tool, individuals are encouraged to become aware of how they regulate their mental processes in certain situations, promoting self-monitoring and reflection on cognitive patterns. With this understanding, and subsequent reflection in coaching sessions, individuals can identify when and how serenity is lost or regained, providing a framework for understanding internal conflicts and enhancing self-regulation.

## Appendix: The Serenity Barometer

The Serenity Barometer – a tool for self-reflection on mental self-regulation, adaptable to the context in which composure may be lost.

Reflection and sensitization to the mental processes that internally affect the extent of serenity.

This self-reflection tool offers you the opportunity to get an impression of how you are dealing with a difficult situation and how you experience it, ranging from a more relaxed state to a less relaxed state. A first step toward better composure is to recognize when and in what way you are intervening in your own thoughts and feelings, your thoughts are going round in circles, and the level of mental tension is increasing.

If you use the Serenity Barometer more often, you can also focus on whether using it changes anything and makes you more sensitive to the way you mentally regulate yourself – how you experience and process circumstances. You can then consider what you can change and what support you need to become more relaxed in these situations.

Before you start working with the Serenity Barometer, here are a few tips on how to use it:

### **Understanding Serenity**

Serenity is a state of mind associated with inner calm, thoughtfulness, mindfulness, and foresight. Having a serene attitude can prevent us from exhausting our energies on situations that are unavoidable. It means accepting the situation we find ourselves in as it is and using our mental energy instead to deal with “what is.”

### **What Happens When Serenity Is Lost?**

Stress, anger, and a feeling of helplessness are examples of a lack of serenity and the inner conflicts that result. Trying to suppress such emotions and “pull yourself together” instead can also lead to a loss of serenity and mental blocks. Both of these can lead to a kind of tunnel vision that limits the scope for action and obscures possible solutions.

The attempt to mentally shape things according to our expectations clashes with actual processes and circumstances. Such expectations manifest themselves in self-directives, such as “I absolutely must ...!” or “Under no circumstances should ...!” These so-called imperatives create tension.

**Using the barometer to assess how your mind works and feel about yourself in challenging situations**

First, decide which challenge you want to use the barometer for and how often you want to use this self-assessment – once a day, once a week or specifically after certain challenges.

Each line is a self-contained unit consisting of two contrasting statements. Please read carefully both the statement on the left and the statement on the right of the barometer and relate these statements to the period or situation you have chosen. Then, tick the box for the statement that comes closest to how you feel about yourself in the chosen situation. If neither of the two statements is more or less true, please put a cross in the middle. At the end, you ticked each of the statements.

Finally, connect all the crosses with a pencil, leaving out the “does not apply” crosses. How to do this and how to get the result is explained in more detail at the end of the Serenity Barometer.

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## A.1 The Serenity Barometer

After choosing the situation (\_\_\_\_\_), please tick to indicate which applies:

|                                                                                                                              | yes,<br>exactly       | tend<br>to<br>agree   | does<br>not<br>apply  | tend<br>to<br>agree   | yes,<br>exactly       |                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Self-communication</b>                                                                                                    |                       |                       |                       |                       |                       |                                                                                                                                                     |
| I <b>did not</b> put myself under pressure when I wanted to change something.                                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I put <b>a lot of pressure</b> on myself when I wanted to change something.                                                                         |
| When _____ was very exhausting for me, I was able to encourage myself without putting pressure on myself (“You can do it.”). | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | When _____ was very exhausting for me, I was able to encourage myself, but I kept pressuring myself (“You’ve got to succeed!”).                     |
| When I was upset about _____ or hard on myself, I was able to stop and regain my serenity.                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | When I got upset about _____ or was hard on myself, I could not stop – or only by forcing myself to stop. This troubled me.                         |
| When I had thoughts about _____, my thoughts were such that I could see things as they are (“Yes, that’s the way it is.”).   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | When I had thoughts about _____, I judged myself for it and wished for another reality (“This must not happen!” or “That definitely must happen!”). |
| <b>Self-perception</b>                                                                                                       |                       |                       |                       |                       |                       |                                                                                                                                                     |
| I was able to recognize immediately when I was overwhelmed, exhausted or tense, or when I was upset or stressed.             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | It was only much later, or in retrospect, that I realized that I was overwhelmed, exhausted, or tense, or that I was upset or stressed.             |
| I could allow myself to notice that I needed _____ (e.g. support/a break).”                                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I could <b>not</b> allow myself to notice that I needed _____ (e.g. support/a break).                                                               |

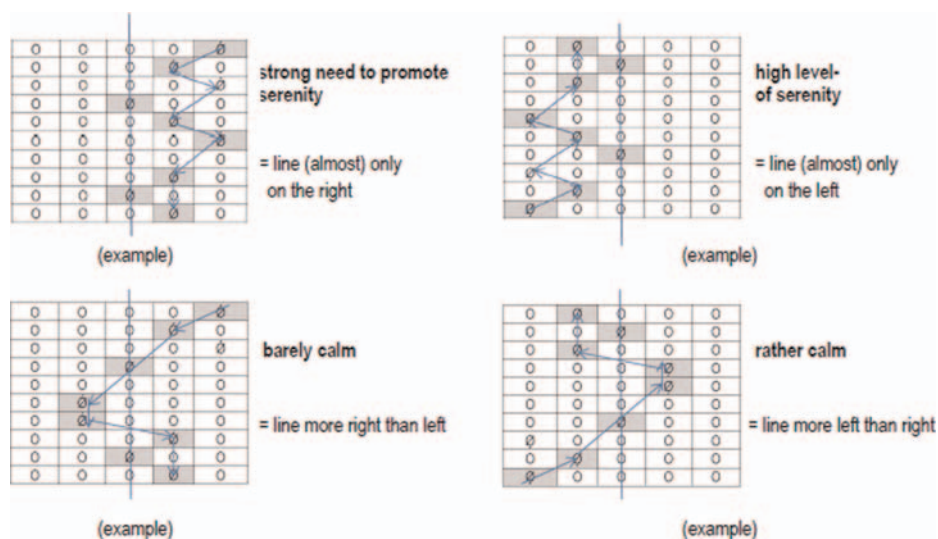
|                                                                                                                      | yes,<br>exactly       | tend<br>to<br>agree   | does<br>not<br>apply  | tend<br>to<br>agree   | yes,<br>exactly       |                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------|
| I was in touch with the limits of my strength.                                                                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I went beyond the limits of my strength because I did not perceive them.                                                     |
| I could notice when I had lost my serenity, for example, when I tensed up or got upset about things or people.       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I could <b>not</b> notice when I had lost my serenity. The lack of serenity happened quite automatically.                    |
| <b>Managing Emotions and Moods</b>                                                                                   |                       |                       |                       |                       |                       |                                                                                                                              |
| At least for the moment, I was able to let go of the things that worried me.                                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I could not stop thinking about things that worried me, and they kept coming back to me. My thoughts went around in circles. |
| When I was not calm and aware of it, I was able to accept it first – and then I felt better.                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | When I was not calm and aware of it, it was even more distressing.                                                           |
| When unpleasant thoughts and worries arose, I realized that dwelling on them would not lead to change or a solution. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | When unpleasant thoughts and worries arose, I kept thinking about them and became very worried.                              |
| I was able to notice when I felt _____ (→insert something uncomfortable) and was able to accept that about myself.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I was able to notice when I felt _____ (→insert something uncomfortable) and could not take it very well.                    |
| <b>Managing the limits of influence</b>                                                                              |                       |                       |                       |                       |                       |                                                                                                                              |
| I was able to come to terms with the nature or behavior of _____ without immediately trying to change it.            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I was <b>not</b> able to come to terms with the nature or behavior of _____ without immediately trying to change it.         |
| I could bear the thought that _____ could change for the worse / is unchangeable.                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I could <b>not</b> bear the thought that _____ could change for the worse / is unchangeable.                                 |
| <b>Scope of action</b>                                                                                               |                       |                       |                       |                       |                       |                                                                                                                              |
| I was able to get help, and that was perfectly fine.                                                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I was able to get help, but it made me even more stressed.                                                                   |
| In this difficult situation with _____, I was able to remain patient.                                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | In this difficult situation with _____, I was <b>not</b> able to remain patient.                                             |
| In this difficult situation with _____, I was able to behave in a way that I felt was appropriate and successful.    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | In this difficult situation with _____, I was <b>not</b> able to behave in a way that I felt was appropriate and successful. |

|                                                                                | yes,<br>exactly | tend<br>to<br>agree | does<br>not<br>apply | tend<br>to<br>agree | yes,<br>exactly |                                                                                                                 |
|--------------------------------------------------------------------------------|-----------------|---------------------|----------------------|---------------------|-----------------|-----------------------------------------------------------------------------------------------------------------|
| In this difficult situation with _____, I had an appropriate response in mind. | O               | O                   | O                    | O                   | O               | In this difficult situation with _____, I realized how I could have responded better only afterward, if at all. |

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## A.2 Evaluation

Connect the dots, leaving out the crosses in the middle (“does not apply”). This will create a picture that you can use to take a snapshot of your level of serenity as a basis for reflection (**Figure 1**):



**Figure 1.**  
Four different examples of serenity levels to compare with your result.

For further reflection, you are invited to review the statements and your level of agreement.

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## **Author details**

Renate Kosuch  
TH Köln - University of Applied Sciences, Cologne, Germany

\*Address all correspondence to: [renate.kosuch@th-koeln.de](mailto:renate.kosuch@th-koeln.de)

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# Perspective Chapter: Mindful Metacognition – A Twenty-First Century Biohack for Adaptive Well-Being and Collective Flourishing

*Patricia A. Jennings*

## Abstract

This chapter introduces mindful metacognition as a critical biohack for the twenty-first century—a powerful, evidence-based approach to addressing chronic stress, emotional reactivity, cognitive overload, and social fragmentation. Drawing from evolutionary psychology, neuroscience, and contemplative traditions, the chapter explores how modern life activates maladaptive threat responses, undermining both physical and mental health. It presents mindful metacognition as a holistic strategy for effectively observing, regulating, and transforming cognitive and emotional experiences. The chapter begins by reviewing theoretical models linking mindfulness and metacognition to psychological flexibility and resilience, emphasizing their complementary roles in reducing experiential avoidance. It then highlights how mindful metacognitive practices mitigate physiological stress responses, reduce chronic disease risks, and promote sustained healthspan—years characterized by good health and functional independence. Educational and therapeutic implications are discussed, demonstrating how these practices improve emotional regulation, cognitive flexibility, and overall well-being. Practical strategies for integrating mindful metacognition into daily life and professional practice are presented, alongside explicit attention to their role in enhancing social interactions, communication, and community cohesion. The chapter concludes with recommendations for further research into the biological, psychological, and social impacts of mindful metacognition, advocating for policies supporting its widespread adoption in healthcare, education, and workplace settings. By equipping individuals and communities with the tools to respond adaptively rather than reactively, mindful metacognition emerges as essential for navigating contemporary challenges and fostering human flourishing.

**Keywords:** mindfulness, metacognition, stress reduction, healthspan, resilience

## 1. Introduction

In contemporary society, individuals are increasingly confronted with chronic stress, emotional reactivity, and cognitive overload—symptoms that reflect the overactivation of evolutionarily adaptive but now often maladaptive survival systems. The threat system, which evolved to detect and respond to physical danger, is now frequently triggered by psychosocial abstract stressors such as political polarization, economic uncertainty, and digital hyperconnectivity [1]. Paul Gilbert's tripartite model of emotion regulation—comprising the threat, drive, and soothing systems—provides a foundational framework for understanding how this dysregulation emerges and why it matters [2].

In parallel, the scientific study of mindfulness has gained traction as a means of fostering regulation, resilience, and psychological flexibility. Early operational definitions emphasized attention regulation and an accepting orientation toward experience [3]. Recent work has refined this view, offering a more comprehensive account that includes attentional, emotional, cognitive, and interoceptive domains, all approached with equanimity and a non-controlling stance [4]. Mindfulness, in this sense, is not a passive state of awareness but a metacognitive mode of engagement with experience.

Indeed, an emerging literature underscores the synergy between mindfulness and metacognition. While mindfulness supports moment-to-moment awareness, metacognition refers to the capacity to observe, evaluate, and regulate one's own cognitive processes [5, 6]. This metacognitive dimension is critical to distinguishing mindfulness from mere attention. As Solem et al. [7] and Wunder and Jones [8] have shown, components such as nonjudgment, acting with awareness, and experiential acceptance are deeply tied to metacognitive beliefs and skills. These capacities enable individuals to disengage from maladaptive cognitive habits—such as repetitive negative thinking and experiential avoidance—thus promoting mental health and resilience.

Recent longitudinal research from the ReSource Project further demonstrates that mindfulness training can yield domain-specific enhancements in cognitive functioning, particularly in working memory and attentional control [9]. However, effects on metacognitive sensitivity appear more nuanced, suggesting that different components of mental training (e.g., attention-focused vs. perspective-taking practices) differentially engage metacognitive systems [9]. This supports the view that mindfulness, when practiced with metacognitive intentionality, can become a powerful lever for cognitive and emotional adaptation.

This chapter proposes that mindful metacognition represents a critical biohack for the twenty-first century, providing essential tools for managing stress and fundamentally transforming how individuals relate to their thoughts, emotions, health, relationships, and environments. The chapter begins by exploring the evolutionary origins and contemporary overactivation of the threat system; current theoretical and empirical models linking mindfulness and metacognition; and how mindful metacognition can disrupt experiential avoidance and foster psychological flexibility. It further examines the physiological health benefits associated with mindful metacognitive practices, particularly their role in reducing chronic stress-related disease risk and promoting healthspan. The discussion then moves to practical applications in educational and therapeutic settings, emphasizing implications for resilience, emotional regulation, and cognitive flexibility.

Additionally, the chapter investigates how mindful metacognition enhances the functioning of the evolutionary soothing and drive systems, promoting emotional

resilience, interpersonal connectedness, and adaptive motivation. Practical strategies for cultivating mindful metacognition in everyday life are presented, followed by an exploration of its critical role in social interactions, communication, and community building. The chapter concludes by considering broader implications for human development and social flourishing and offering recommendations for further integration of mindful metacognition into research, practice, policy, and everyday life.

## **2. The evolutionary brain and the overactive threat system**

Human emotional systems are the product of evolutionary pressures that prioritized survival in environments characterized by immediate, acute, physical threats. Central among these systems is the threat response, which functions to detect danger and activate protective behaviors—typically manifested as fight, flight, or freeze responses. While highly adaptive in ancestral contexts, where threats were acute and survival depended on rapid response, the continued operation of these systems in modern environments has introduced new vulnerabilities.

Paul Gilbert's tripartite model of emotion regulation delineates three interacting systems: the threat system, associated with fear, anxiety, and defensiveness; the drive system, associated with motivation and achievement; and the soothing system, linked to safety, contentment, and social bonding [2]. The threat system is fast-acting and is mediated by brain regions such as the amygdala and the hypothalamic-pituitary-adrenal (HPA) axis. It is designed to prioritize speed over accuracy, frequently relying on heuristics and prior learning to respond to perceived danger quickly and automatically.

In modern life, however, many of the stimuli that activate the threat system are not immediate or life-threatening, but rather abstract, symbolic, or social—such as negative evaluations, news alerts, or ideological disagreements. Unlike time-limited physical threats, these modern stressors are often persistent, abstract, and difficult to resolve. This creates a mismatch between the evolved design of the threat system and the realities of contemporary stress exposure, leading to chronic dysregulation of physiological and psychological processes [10].

One of the most salient consequences of this dysregulation is the erosion of cognitive and emotional flexibility. The chronic activation of the threat system disrupts prefrontal cortical functions responsible for attention, working memory, and emotion regulation, resulting in increased impulsivity, reduced perspective-taking, and difficulties in sustained reflection [10]. These impairments are compounded by the fact that many modern environments—especially those shaped by algorithmic media, economic precarity, and political polarization—are designed to capture attention and amplify threat-related content [11, 12].

The persistence of these conditions gives rise to what Gilbert describes as a “threat-dominant” motivational landscape, in which individuals are disproportionately driven by fear and avoidance, rather than by curiosity, connection, or creativity [2]. The long-term activation of this threat-based system is also associated with increased vulnerability to psychological disorders, including anxiety, depression, and post-traumatic stress disorder (PTSD) [13, 14]. Moreover, chronic stress has profound effects on physical health. Sustained activation of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system can lead to systemic inflammation, increased blood pressure, and impaired immune function, contributing to the development of cardiovascular disease, hypertension, type 2 diabetes, and metabolic syndrome [1, 15, 16].

Moreover, the dominance of the threat system is not merely an individual problem—it has collective implications. When populations are caught in cycles of threat reactivity, the social fabric begins to fray. Empathy diminishes, in-group/out-group thinking intensifies, and cooperative capacities decline [17, 18]. In such conditions, the ability to pause, reflect, and regulate one's internal state becomes not only a personal virtue but a civic necessity.

Understanding the evolutionary basis of the threat system and its maladaptive activation in modern contexts underscores the urgency of cultivating counterbalancing capacities. This sets the stage for the role of mindfulness and metacognition as intentional practices that can downregulate threat-based reactivity and re-engage the brain's more adaptive, integrative systems.

### **3. Theoretical models of mindfulness and metacognition**

The scientific study of mindfulness has evolved significantly since its introduction into Western psychology. Early operational definitions, such as the one proposed by Bishop and colleagues [3], framed mindfulness as the self-regulation of attention on present-moment experience, accompanied by an attitude of curiosity, openness, and acceptance. This model provided a pragmatic basis for empirical research and clinical interventions yet left ambiguity regarding the underlying cognitive and neurobiological mechanisms.

More recent integrative definitions have sought to clarify mindfulness both as a process and as a mode of consciousness. Chems-Maarif et al. [4] proposed a multi-dimensional model comprising attentional, interoceptive, emotional, and cognitive domains, each approached with an equanimous and non-controlling stance. This refinement aligns mindfulness more closely with a metacognitive framework, emphasizing its regulatory and reflexive functions.

Metacognition itself refers to one's capacity to monitor and control cognitive processes [5, 6]. It encompasses both metacognitive knowledge (beliefs about one's thinking) and metacognitive regulation (strategies used to control cognitive activity). In the context of emotional disorders, metacognitive theory suggests that maladaptive beliefs—such as the belief that worrying is uncontrollable or that thoughts must be suppressed—sustain psychological distress through what Wells and Matthews [19] term the Cognitive Attentional Syndrome (CAS). The CAS includes worry, rumination, threat monitoring, and dysfunctional coping, all of which are underpinned by metacognitive beliefs.

The intersection between mindfulness and metacognition has become increasingly salient in recent research. Empirical findings indicate that certain facets of mindfulness—particularly nonjudgment, acting with awareness, and nonreactivity—are strongly associated with adaptive metacognitive processes [7, 8]. Solem et al. [7] found that metacognition, rather than mindfulness per se, was a stronger predictor of symptoms of anxiety, depression, and obsessive-compulsive behaviors, suggesting that the mechanisms of change may reside in one's ability to regulate attention and disengage from automatic cognitive routines.

Furthermore, as Wunder and Jones [8] argue, mindfulness should be understood as a metacognitive skill set that involves not only noticing experience but also shifting one's relationship to it. In this view, mindfulness entails the ability to decenter from thoughts and feelings, regard them as transient mental events, and choose a more adaptive cognitive stance. This capacity is essential for weakening the CAS and building psychological flexibility.

Neuroimaging research supports these distinctions. Studies indicate that mindfulness practice can modulate activity in the default mode network, anterior cingulate cortex, and dorsolateral prefrontal cortex—areas associated with self-referential processing, cognitive control, and emotion regulation [20]. These neural changes suggest that mindfulness and metacognition may operate through overlapping but distinct mechanisms, with mindfulness fostering metacognitive awareness and metacognition guiding the strategic deployment of attention and interpretation.

Together, these theoretical frameworks underscore the value of conceptualizing mindfulness not merely as a form of attention but as a metacognitively informed process that supports emotional regulation, resilience, and adaptive functioning. In the next section, we explore how these insights apply to real-world challenges, particularly in disrupting patterns of experiential avoidance and cultivating psychological flexibility.

#### **4. Disrupting experiential avoidance and cultivating psychological flexibility**

A core contributor to psychological distress is the tendency to avoid or suppress internal experiences—a pattern referred to in the literature as experiential avoidance. This tendency, while understandable from a threat-avoidance standpoint, often exacerbates suffering by reinforcing a rigid stance toward discomfort and perpetuating the Cognitive Attentional Syndrome (CAS) described by Wells and Matthews [19]. From this perspective, mindfulness and metacognition provide complementary mechanisms for disrupting these maladaptive cycles.

Mindfulness fosters an accepting and nonreactive stance toward internal experience. Rather than attempting to eliminate unwanted thoughts or emotions, mindfulness practice encourages individuals to observe these phenomena with openness and equanimity. This shift is not passive resignation but an active engagement with experience that weakens the need for suppression or avoidance. Research suggests that this capacity to “stay with” discomfort—without becoming entangled in it—leads to reductions in stress, anxiety, and emotional reactivity [21].

Metacognitive strategies enhance this process by allowing individuals to recognize maladaptive thought patterns as they arise and to choose whether or how to respond to them. This capacity is critical in interrupting the habitual use of control strategies such as worry, rumination, or distraction, which are often deployed in response to perceived psychological threat. When individuals learn to see their thoughts as mental events rather than facts, they become more able to disengage from them, thereby enhancing psychological flexibility—the ability to act in accordance with values despite the presence of challenging internal states [22].

Importantly, psychological flexibility has been linked to a wide range of positive outcomes, including lower levels of depression and anxiety, better physical health, and improved relationship quality [23]. Interventions such as Acceptance and Commitment Therapy (ACT) explicitly target this flexibility, and evidence suggests that both mindfulness and metacognitive training may enhance its development [24]. Thus, cultivating mindful metacognitive awareness can serve as a powerful pathway toward resilience in the face of uncertainty and distress.

The next section explores how these mechanisms—disruption of experiential avoidance and enhancement of psychological flexibility—can be operationalized in educational and therapeutic settings, with implications for both individual and collective well-being.

## **5. Mindful metacognition, stress reduction, and physical health outcomes**

Chronic stress, driven by ongoing activation of the threat response system, significantly affects not only mental health but also physical health, contributing to numerous chronic diseases prevalent in contemporary societies. Prolonged activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system leads to persistent elevations in cortisol and pro-inflammatory cytokines, resulting in systemic inflammation, immune dysregulation, and metabolic disruptions. These physiological changes are strongly linked to increased risks for cardiovascular disease, hypertension, type 2 diabetes, obesity, chronic pain syndromes, and autoimmune conditions [15].

Mindful metacognition offers a practical and evidence-based strategy to mitigate these negative health impacts. By cultivating awareness of one's cognitive and emotional states and actively regulating responses, mindful metacognitive practices effectively reduce physiological stress markers. Numerous studies highlight the effectiveness of mindfulness interventions in lowering cortisol levels, inflammatory biomarkers, blood pressure, and improving immune function [25, 26]. For instance, mindfulness-based stress reduction (MBSR) programs have been shown to decrease inflammation and enhance immune responses, thus promoting better overall physical health [27, 28].

Moreover, mindful metacognition not only contributes to the reduction of disease risk but also supports healthspan—the period of life characterized by good health, functional independence, and well-being, while lifespan refers merely to longevity, healthspan emphasizes the quality and vitality of life years. Mindful metacognitive practices can positively influence healthspan by enhancing emotional resilience, cognitive flexibility, and stress management capacities, thereby promoting healthier lifestyle behaviors such as improved diet, increased physical activity, and adherence to preventive health measures [29].

Research also suggests mindfulness practice contributes to cellular health and aging, potentially slowing biological aging markers such as telomere shortening, a robust indicator of cellular aging and chronic stress exposure [30]. By extending the duration of health and functional independence rather than merely extending years of life, mindful metacognition can significantly enhance quality of life and well-being at the individual and societal levels. Thus, incorporating mindful metacognition into healthcare, workplace wellness, and public health initiatives holds substantial promise for addressing chronic disease burdens, reducing healthcare costs, and promoting a healthier and more resilient population.

## **6. Applications in education and mental health**

The integration of mindfulness and metacognition into education and therapeutic practice offers promising pathways for enhancing emotional well-being, cognitive flexibility, and self-regulation. In educational settings, these capacities can be cultivated through programs tailored separately for educators and students, each with distinct aims and mechanisms.

For educators, mindfulness-based professional development programs aim to enhance teachers' own emotional competence and stress management capacities. Programs such as CARE for Teachers provide structured support in developing mindfulness and emotion regulation skills, leading to improved classroom climate, stronger teacher-student relationships, and increased instructional efficacy. A large-scale

randomized controlled trial of CARE in urban elementary schools found significant improvements in teacher mindfulness, emotion regulation, psychological distress, and classroom emotional support [31].

For children and youth, developmentally appropriate mindfulness programs are increasingly incorporated into social-emotional learning (SEL) curricula. These programs, including MindUP and the Compassionate Schools Project (CSP), integrate mindfulness, compassion, and wellness practices into the school day. Evaluations of CSP have shown improvements in student attention and self-regulation, particularly among those in high-poverty contexts [32]. Mindfulness-based SEL programs support the development of metacognitive awareness in children, which contribute to academic engagement, emotional self-awareness, and behavioral regulation [33].

Metacognitive training within schools complements these efforts by fostering students' awareness of their own thinking and learning processes. Embedding mindful metacognitive practices in daily routines—such as breathing exercises, guided reflection, or journaling—can promote sustained attention, reduce anxiety, and build adaptive responses to academic and social challenges [34].

In therapeutic contexts, mindfulness and metacognitive strategies are central to evidence-based treatments for a range of psychological disorders. Mindfulness-Based Cognitive Therapy (MBCT) [35], Metacognitive Therapy (MCT) [36], and Acceptance and Commitment Therapy (ACT) [37] each emphasize the development of awareness and cognitive distancing to reduce symptom severity and prevent relapse. Therapists using a metacognitive approach help clients identify and modify dysfunctional metacognitive beliefs (e.g., “I must control all my thoughts” or “Worrying keeps me safe”), replacing them with a more adaptive stance that allows thoughts to arise and pass without undue entanglement. Mindfulness supports this process by training attention and reducing automatic reactivity to internal experiences. When combined, these modalities foster cognitive flexibility, emotional resilience, and a more compassionate stance toward the self.

Given the increasing mental health burden globally, integrating mindful metacognitive strategies into systems of care and education represents a scalable and preventive public health intervention. The next section provides concrete practices for cultivating these skills in everyday life.

## **7. Mindful metacognition and the evolutionary systems of soothing and drive**

While much of this chapter has focused on how mindful metacognition helps regulate the threat system, its role in enhancing the two other emotion regulation systems identified by Gilbert [2]—the soothing and drive systems—is equally vital for fostering resilience and well-being. The soothing system, associated with feelings of safety, affiliation, and contentment, can be intentionally activated through practices that cultivate positive emotions and interpersonal connection.

Research has demonstrated that experiencing and savoring positive emotions—particularly when shared with others—can broaden attention, build psychological resources, and strengthen social bonds [29]. Mindful metacognition supports this process by enabling individuals to notice, prolong, and reflect on moments of warmth, joy, or gratitude. When practiced in relational settings—such as mindful listening, loving-kindness meditation, or shared reflection—these habits help build affiliative safety and connection, creating a buffer against stress and social isolation.

The drive system, responsible for motivation, goal pursuit, and achievement, can also benefit from mindful metacognitive awareness. Without regulation, the drive system may lead to perfectionism, overwork, or compulsive striving. Mindful metacognition offers a counterbalance by allowing individuals to observe their goal-oriented impulses, evaluate their alignment with deeper values, and adjust behavior accordingly. By cultivating awareness of motivational patterns and their effects on well-being, individuals can pursue goals with focus and passion—without becoming consumed by them. This supports a more sustainable, balanced engagement with ambition and growth.

Together, mindful engagement with the soothing and drive systems helps individuals not only reduce distress but also foster vitality, purpose, and belonging. These capacities are central to resilience and human flourishing and reinforce the idea that mindful metacognition is not simply a method for reducing suffering, but a comprehensive framework for optimizing adaptive functioning.

## **8. Practical strategies for cultivating mindful metacognition**

Building on the theoretical foundations explored in earlier sections, practical strategies for cultivating mindful metacognition must reflect both the complexity of the human mind and the neurocognitive systems described by Gilbert, Flavell, and others. Practices should be designed not simply to reduce stress, but to reorient individuals toward a deeper and more intentional relationship with their thoughts, emotions, and behaviors.

Drigas and Mitsea [38] offer a useful synthesis in their metacognition-based eight-pillar model of mindfulness, which emphasizes a developmental pathway beginning with self-awareness and culminating in the cultivation of sustained attention to one's deeper purpose and values. Their framework, informed by earlier work on mindfulness and executive function [39], suggests that practices must simultaneously engage attentional regulation, cognitive flexibility, and emotional insight.

To translate these insights into practice, three key dimensions emerge as especially relevant:

1. **Developing meta-awareness:** As discussed in Section 3, metacognitive awareness involves recognizing one's mental states without becoming entangled in them. Practices such as open monitoring meditation and periodic “mental check-ins”—asking oneself -what thoughts or emotions are present—support this skill. This helps disrupt the habitual activation of the threat system by creating space between stimulus and response [3].
2. **Strengthening reflective attention and emotion regulation:** Mindfulness practices that focus on breath, body, or emotion serve to stabilize attention and regulate arousal. These effects are not only calming but also metacognitively rich, as they promote insight into how inner states shift moment to moment. When paired with strategies like self-questioning (e.g., “Is this thought helpful?”), these exercises help individuals choose more adaptive responses [35, 36].
3. **Cultivating intentional and value-aligned action:** Finally, mindful metacognition must be directed toward intentional behavior. Practices that integrate goal setting with present-moment awareness—such as reflective journaling, values

clarification, or action planning grounded in compassionate awareness—help anchor mindfulness in meaningful engagement. This supports long-term resilience and aligns cognitive resources with prosocial outcomes [37].

Together, these dimensions support the development of a stable and wise inner observer—an internal posture from which one can navigate life with both clarity and equanimity. While the eight-pillar framework of Drigas and Mitsea [38] provides one valuable lens, these principles resonate with broader research in mindfulness-based cognitive therapy, acceptance and commitment approaches, and contemporary contemplative science. The next section considers how such inner transformation can contribute to broader human flourishing.

## **9. The role of mindful metacognition in social interactions**

Effective social interaction relies heavily on one's ability to recognize, interpret, and respond adaptively to the cognitive and emotional states of oneself and others. Mindful metacognition significantly enhances this capacity by fostering heightened self-awareness, emotional intelligence, and cognitive flexibility during interpersonal exchanges. By cultivating a habit of observing internal emotional and cognitive responses in real-time interactions, individuals can better manage their impulses, regulate emotional expressions, and respond thoughtfully rather than reactively.

For example, mindful metacognitive practices such as reflective listening and compassionate perspective-taking can substantially improve communication skills. Individuals trained in these practices become more attuned to subtle social cues and nonverbal signals, enabling more empathetic and nuanced responses. This skill is particularly beneficial during conflicts or emotionally charged interactions, where the ability to pause and consider the broader context and perspectives of others helps prevent misunderstandings and escalations.

Research has demonstrated that metacognitive awareness supports emotional regulation strategies that directly enhance relationship quality, including reduced defensiveness, increased openness to feedback, and improved conflict resolution capabilities [40–42]. Furthermore, mindfulness-based interventions targeting metacognitive awareness have shown efficacy in enhancing social functioning among diverse populations, including educators [43], healthcare professionals [44], and adolescents [45].

Ultimately, mindful metacognition provides the cognitive and emotional clarity needed to engage in social relationships more authentically and constructively. These skills not only enhance individual well-being but also contribute to healthier and more resilient communities.

## **10. Implications for human development and social flourishing**

As the demands of modern life intensify, so does the need for capacities that allow individuals to navigate complexity with composure and care. Mindful metacognition is not merely a tool for stress reduction—it is a developmental capacity that fosters cognitive flexibility, ethical discernment, and relational presence. The implications of its cultivation extend far beyond individual well-being.

From a developmental perspective, mindful metacognition supports the maturation of executive function, self-regulation, and emotion awareness across the lifespan.

In early childhood, foundational practices build attentional control and social-emotional understanding [39]. In adolescence, these skills help counter impulsivity, identity confusion, and social stress. In adulthood, they enable greater perspective-taking, conflict resolution, and intentional living.

At the societal level, widespread cultivation of mindful metacognition could shift collective norms. Increased awareness of one's cognitive and emotional processes may reduce polarization, improve civil discourse, and increase prosocial behavior [46]. Individuals capable of recognizing their biases and regulating their emotional reactivity are better equipped to engage constructively in democratic life and respond ethically to global challenges.

Moreover, in professional domains—education, healthcare, leadership, and caregiving—these capacities are essential. Educators with strong metacognitive awareness foster psychologically safe learning environments that may have “downstream” impacts on their students’ engagement, motivation, and learning [47]. Leaders grounded in mindful presence make more ethical, clear-headed decisions. Clinicians and caregivers with these skills are more attuned, empathetic, and resilient.

In this way, mindful metacognition can be viewed as a keystone human capacity for the twenty-first century—linking the intrapersonal to the interpersonal, the cognitive to the ethical, and the individual to the collective. The final section offers concluding reflections and recommendations for further integration of these insights into research, practice, and policy.

## **11. Conclusion and recommendations**

This chapter has argued that mindful metacognition is a critical biohack, providing a powerful framework for addressing chronic stress, emotional reactivity, and cognitive overload prevalent in modern life. By understanding the evolutionary basis of the threat response system and integrating mindfulness with metacognitive strategies, individuals can effectively manage internal states, cultivate emotional resilience, and foster psychological flexibility. Such skills are essential not merely for individual well-being, but also for the health and resilience of broader communities.

The incorporation of mindful metacognition into daily life holds significant potential for improving physical health outcomes by mitigating the detrimental physiological effects of chronic stress. As discussed, mindful metacognitive practices can lower stress biomarkers, reduce inflammation, and enhance immune function, ultimately contributing to reduced risks of chronic illnesses and extending healthspan—the years spent living in good health rather than merely extending lifespan. Given the global burden of stress-related illnesses, policy and public health initiatives should consider embedding mindfulness and metacognitive strategies into preventive healthcare, workplace wellness programs, and broader health education. Research and practice should continue to explore the mechanisms through which these practices impact biological aging markers, such as telomere length, to better understand and leverage their full potential for promoting sustained health and vitality.

Additionally, mindful metacognition significantly enhances social interactions and relationships by improving emotional intelligence, interpersonal awareness, and communication skills. The ability to recognize one's cognitive and emotional responses during interpersonal exchanges and manage these effectively is vital in reducing conflicts, enhancing cooperation, and fostering meaningful connections. Educational institutions, workplaces, and community organizations would benefit

from integrating training that explicitly targets these interpersonal aspects. Programs should focus on practices such as reflective listening, perspective-taking, and compassionate communication to build more empathetic, responsive, and cohesive social environments.

Looking forward, future research should address existing gaps by longitudinally evaluating the sustained impacts of mindful metacognitive practices on both physical health markers and social-emotional competencies. Investigations should further clarify how these interventions can be tailored for diverse populations, considering cultural sensitivity, inclusivity, and accessibility. Additionally, continued investment in rigorous facilitator training and professional development is essential for ensuring high-quality program implementation across various contexts.

At the policy level, advocating for the systemic integration of mindful metacognitive education within healthcare, education, and organizational frameworks will be crucial. Recognizing mindful metacognition as a foundational capacity could inform health policy decisions, educational curricula, and workplace practices, thereby cultivating greater resilience and well-being on a societal scale.

In conclusion, the intentional cultivation of mindful metacognition represents an essential form of adaptive agency. By developing the capacity to respond thoughtfully rather than react impulsively, to connect authentically rather than divide defensively, and to foster healthspan alongside social cohesion, mindful metacognition empowers individuals and communities alike to thrive in an increasingly complex and interconnected world.

## Author details

Patricia A. Jennings  
University of Virginia, Charlottesville, VA, United States

\*Address all correspondence to: [tishjennings@virginia.edu](mailto:tishjennings@virginia.edu)

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# Toward Metacognitive Balance: A Framework for Cognitive and Social Functioning in Schizophrenia

*Mihwa Han and Hoedeok Gu*

## Abstract

Diverse perspectives and practice-based efforts on metacognition have been important stepping stones for advancing understanding and interventions for cognitive and social functioning in schizophrenia. Among these, the sequential two-stage approach proposed in the Metacognitive Intervention for Schizophrenia—which prioritizes self-awareness and subsequently extends to context/other-awareness—has contributed to gains in self-awareness and improvements in social cognition and functioning. In practice, however, its clinical use has surfaced theoretical and practical questions about the ordering assumption. This chapter critically appraises that assumption and advances a balance-oriented perspective that centers on the concurrent co-regulation of self- and context/other-awareness. Integrating general psychological principles and personality theory, it argues that maintaining such a balance is pivotal for curbing biases such as excessive introspection and excessive externalization. The chapter also sketches this perspective’s educational and clinical relevance and outlines avenues for theoretical refinement and practical development.

**Keywords:** thinking about thinking, metacognitive intervention, self-awareness, context/other-awareness, balance-oriented perspective

## 1. Introduction

Schizophrenia is characterized not only by psychotic symptoms such as delusions and hallucinations, but also by pervasive decrements in social functioning including difficulties in sustaining relationships, fulfilling roles, and adapting to community life [1, 2]. These functional problems extend beyond mere information-processing deficits and are closely linked to failures in metacognitive regulation—that is, lapses in the capacity to consistently integrate and interpret thoughts, feelings, and bodily sensations in light of others’ intentions, prevailing social norms, and situational cues, and to regulate responses accordingly. Clinically, biased metacognitive patterns are frequently observed, such as “jumping to conclusions” (JTC), externalizing/personalizing attributions, theory-of-mind (ToM) deficits, excessive self-focus, or over-orientation to external cues. These are associated with the persistence of symptoms, social withdrawal, and delays in rehabilitation [3–5].

Over the last decade, multiple interventions incorporating a metacognitive perspective (e.g., Metacognitive Interpersonal Therapy [MIT]; Metacognitive Reflection and Insight Therapy [MERIT]; Metacognitive Therapy [MCT, Wells]; Metacognitive Training for Psychosis [MCT, Moritz and Woodward]; Social Cognition Training [SCT]; Social Cognition and Interaction Training [SCIT]; and related programs) have demonstrated benefits for symptom reduction and social-cognitive enhancement [6–11]. Nevertheless, many programs (1) target the subcomponents of metacognition (emotion recognition, attributional style, ToM) in a localized fashion or (2) proceed in linear, modular sequences [8, 10, 12]. In actual clinical contexts, thought content, affect, and situational cues interact concurrently, and the relative reliance on internal versus external metacognition fluctuates within individuals [13]. Hence, beyond the question of what to train “first,” a core therapeutic task is how to restore and maintain balance [14, 15].

To address this need, a sequential two-stage model—Metacognitive Intervention for Schizophrenia (MCI-S)—was proposed and implemented. It (1) prioritizes self-awareness and then (2) extends to context/other-awareness [16]. In a nonequivalent control group pre-post quasi-experiment with Korean adults with schizophrenia (see the original paper for sample size, outcomes, and time points), MCI-S was associated with significant reductions in delusions and improvements in social cognition and social functioning. However, changes in insight and auditory hallucinations were limited [16]. This pattern suggests potential asymmetries among metacognitive subcomponents and the persistence, in some participants, of excessive self-focus or over-reliance on external cues. In other words, a strictly sequential “self → context” rule may be insufficient to capture and regulate moment-to-moment cognitive-affective states and situational demands [17, 18].

Thus, the purpose of this chapter is to re-examine the linear (sequential) assumption embedded in MCI-S and to explore a conceptual alternative grounded in balance rather than order. Here, the balance-oriented perspective is not a simple sum of self-awareness and awareness of others and context. It is a dynamic regulatory capacity that coordinates both axes concurrently and interactively, preventing drifts toward over-internalization—excessive self-focus and rumination—and over-externalization—over-reliance on others’ reactions or situational cues. Specifically, this chapter (1) summarizes the theoretical premises and empirical findings of MCI-S; (2) connects clinical observations with general psychology and personality theory to argue for a balance-oriented perspective; and (3) offers practice-oriented implications for assessment, goal setting, and session design in clinical and educational contexts. Operational examples are presented in Section 5.

## **2. Background: Metacognitive intervention for schizophrenia model**

### **2.1 Purpose and basic structure**

MCI-S was designed to remediate the fragmented and asymmetric metacognitive functioning commonly observed in schizophrenia. With real-world application in view, it adopted a linear two-stage structure [16]. Stage 1 (self-awareness metacognition) strengthens the person’s ability to differentiate thoughts, emotions, intentions, and attentional focus and to observe/decouple “cognitive traps” (automatic worry, rumination, thought suppression) from a metalevel [11, 19]. Stage 2 (context/other-awareness metacognition) builds on this strengthened self-awareness to integrate others’ perspectives and social/situational cues, fostering multi-perspective interpretation and the correction of biases such as JTC and externalizing attributions [8, 9].

This sequential approach rests on the pragmatic assumption that self-reflection should precede the integration of external perspectives. In practice, meaningful effects have been reported on delusions, social cognition, and social functioning; however, changes in insight and auditory hallucinations were limited, and some participants exhibited excessive self-immersion (remaining inward) or avoidance of external feedback, highlighting potential instability in balance across the two axes.

## **2.2 Joëlle Proust's philosophy of metacognition: Theoretical augmentation**

Joëlle Proust conceptualizes metacognition not as a unitary “thought about thought,” but as comprising two systems that operate concurrently: procedural (experiential) metacognition and explicit (representational) metacognition [18]. The former is a nonconceptual regulatory system that monitors and corrects ongoing cognitive processing *via* metacognitive feelings such as confidence, fluency, and effort. The latter relies on verbal reflection, evidence contrast, and adoption of others’ perspectives [17, 18]. Metacognition can function partly independently of ToM (while interacting with it), and its core is control—i.e., stop, check, and strategy shift. This view reframes clinically observed phenomena including overconfidence, error-monitoring failures, and the intolerance of ambiguity as trainable control targets.

## **2.3 Bridging the metacognitive intervention model for schizophrenia: From “sequence” to “balance”**

Applying Proust’s view to MCI-S suggests that the two stages should not be strictly separated, but co-regulated [17, 18, 20]. Stage 1 (self-awareness), though anchored in explicit metacognition, would benefit from concurrent calibration<sup>1</sup> of procedural signals, for instance by labeling confidence immediately after judgments and tracking (mis)matches with outcomes (“confidence calibration”). Stage 2 (context/other-awareness), while engaging mindreading and the integration of social cues, would incorporate a stop-and-check routine to automate a short cycle: halt premature closure → generate alternatives → check key evidence [8]. Within Proust’s framework, clinically observed patterns of over-internalization and over-externalization can be understood as miscalibrations of epistemic (metacognitive) feelings [17, 18]. We frame the following as procedural tools implemented under an operating principle, aiming to support the concurrent co-regulation of procedural and explicit metacognition within sessions. In principle, such tools may be used adjunctively within established treatments such as MCI-S, cognitive behavioral therapy (CBT), SCIT, MCT, and MERIT [7, 9–11, 19, 21], provided that any adaptations remain consistent with treatment manuals and therapist competence; their incremental benefit requires empirical evaluation. Their use should also be adapted to treatment fidelity and the patient’s state (e.g., acuity and cognitive load).

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<sup>1</sup> Calibration → as a concept at the level of an operating principle, metacognitive calibration: the process of adjusting one’s judgment rules so that subjective confidence (or fluency) better aligns with post-hoc evidence/accuracy/outcomes. Practically, (1) record confidence (0–10) and a one-line affect label immediately after a judgment, (2) later contrast this with the actual evidence/outcome, (3) note why any mismatch occurred, and (4) update a small rule for the next judgment (e.g., gather two additional cues; adopt a third-person framing first). Progress can be tracked with low-burden indices such as confidence-outcome congruence (e.g., confidence-outcome).

| Item                | MCI-S (sequential)                                                         | Balance-oriented perspective (coregulated)                                                                              |
|---------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Overall principle   | <i>Self</i> → context precedence/sequence                                  | Concurrent coordination of self and context                                                                             |
| Within-session unit | Gated progression: <i>master a stage</i> → <i>move to next</i>             | Repeat micro-cycles (brief and frequent)                                                                                |
| Key risks           | Stage fixation or asynchrony between procedural and explicit metacognition | Excessive switching/complexity ↑ (mitigation—place in Safeguards/footnote: minimize steps; keep cycles short)           |
| Safeguards          | Stage-progression criteria                                                 | Pivot triggers (over-internalization) → context-work (Pivot A); over-externalization → self-work (Pivot B) <sup>†</sup> |
| Assessment          | Module-by-module checks                                                    | Two low-burden indices: confidence-outcome congruence (e.g., confidence-outcome); tolerance of ambiguity                |
| Generalization      | Between-session transfer: variable/limited                                 | Extend the same principles to everyday contexts                                                                         |

<sup>†</sup>Invoked from any step of the micro-cycle to recenter within the adaptive corridor, see **Figure 1**.

**Table 1.**

Key contrasts between a sequential approach and a balance-oriented operation (coregulated).

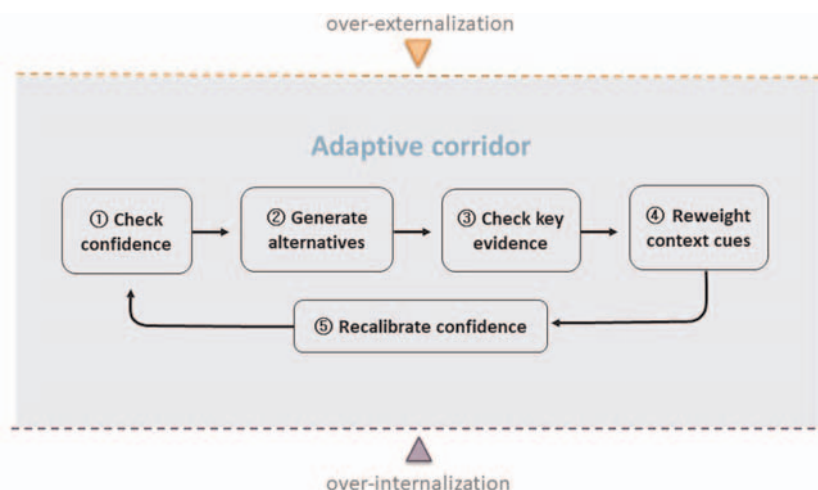
Consequently, Proust’s framework complements the MCI-S assumption of a linear “self → context” sequence with a perspective of concurrent coordination, and provides the theoretical footing for the balance-oriented perspective proposed in this chapter—that is, the dynamic co-regulation of self- and context/other-awareness [17, 18]. In doing so, it points to a next phase of revision that preserves the core strengths demonstrated by MCI-S (reductions in delusions and improvements in social cognition and social functioning), while mitigating the observed imbalances such as limited change in insight and auditory hallucinations, or tilts toward self-absorption and avoidance of external feedback [16].

In the sections that follow, we build on this theoretical reinforcement to articulate a conceptual critique of the sequential assumption and to specify practical operating principles for implementation, including short within-session cycles and immediate pivot triggers (see **Table 1**).

*Summary.* MCI-S is an empirically supported sequential model; incorporating Proust’s philosophy shifts the focus from “what comes first” to “how to coregulate both axes,” by combining calibration of procedural signals with explicit reflection. This forms the basis for the balance-oriented concept developed in the following sections.

## 2.4 Conceptual critique of the sequential assumption

A sequential approach has the virtues of structural clarity and ease of training, evaluation, and manualization; however, it risks over-simplifying metacognition, which in practice operates non-linearly and concurrently [13]. Clinically, asymmetric patterns recur. First, over-internalization (excessive self-focus) appears as amplified



**Figure 1.**  
 Session-level five-step micro-cycle within the adaptive corridor. Triangles mark pivot triggers for over-externalization (top) and over-internalization (bottom); a pivot may be invoked from any step to recenter the process by routing to Step 5 (recalibration).

rumination and guilt or shame, with a preoccupation with “finding the cause within,” thereby blocking corrective input from situational cues. Risk/meaning attributions escalate internally, potentially intensifying anxiety and delusional interpretations. This is an instance of calibration failure in metacognitive feelings where fluency is mistaken for validity [17, 18, 20].

Conversely, over-externalization (dependence on contextual cues) is common. This occurs when one is overly drawn to others’ expressions or behaviors or to rumors while neglecting internal monitoring, hyper-suspiciousness, and threat interpretations (externalizing/personalizing attributions) are reinforced and self-guidance weakens, rendering responses erratic across situations. Decisions are often driven by automatic feelings (“feeling = fact”) without explicit reflection, leading to premature closure (JTC) before controlled re-appraisal comes online [3, 4].

Moreover, in schizophrenia, cognitive flexibility fluctuates within and across days due to the side effects of medication, sleep and stress, negative symptom load, and the inherent ambiguity of face-to-face situations [15, 16, 18]. The internal-external tilt shifts within the same person depending on context; thus, a rigid hierarchy (“complete Stage 1 before Stage 2”) may miss actual needs. In Proust’s dual framework, procedural (feeling-based) and explicit (language/reasoning-based) control should operate concurrently and cross-correct [17, 18]. However, sequential models often privilege one axis first—raising explicit reflection, then introducing the other/context—thereby weakening rapid cycles of confidence calibration → alternative generation → evidence checking and risking desynchrony between procedural and explicit metacognition.

These limitations surface in concrete clinical failures. Prolonged residence in Stage 1 can see “self-observation” training spill into rumination, heightening anxiety or depression, and sapping the motivation to progress. Conversely, hasty progression to Stage 2 may apply another-perspective or social cues without adequate self-checking, risking hypermentalization. Carry-over failures between sessions are common when procedural automation is weak; essentially, skills learned in one session fail to generalize [22]. Discrete “gates” (“meet this condition to advance”) may suppress the continuous

micro-adjustments that genuine change requires. Here, stop-check-shift routines should be iterated multiple times within sessions, although stepwise designs can reduce this frequency [17, 18]. When confidence calibration (procedural) and alternative generation/evidence contrast (explicit) are separated, one is left with errors of feeling on the one hand and impoverished reasoning on the other—i.e., a loss of balance [17, 18].

#### *2.4.1 Practical pivot*

Rather than insisting on completing Stage 1 before Stage 2, sessions should be designed to coregulate self- and context/other-awareness. The focus shifts from sequence to balance, implemented through short, repeated micro-cycles<sup>2</sup>: as follows:

1. Rate current confidence (0–10) and add a one-line state label to counter the assumption that fluency guarantees validity.
2. Generate two to three alternative hypotheses for the same issue.
3. Contrast a few key pieces of evidence and counter-evidence (prioritize depth over breadth).
4. Reweight contextual cues (third-person perspective, cue listing, environmental constraints).
5. Re-rate confidence and note why/how it changed.

Repeating this cycle during case discussions synchronizes metacognitive feelings—confidence, fluency, and effort—with explicit reasoning. In Proust’s framework, these feelings are procedural signals that trigger control operations such as stopping, checking, and shifting [17, 18]. Accordingly, the confidence-check-re-rating steps in the micro-cycle implement a calibration that aligns these procedural signals with explicit reasoning (alternative generation, evidence contrast, and perspective shift) in real time. **Figure 1** conceptually summarizes the session-level operating flow and pivot triggers.

Immediate pivot triggers during sessions should remain lean. When over-internalization is detected (escalating rumination/self-blame, utterances such as “I’m certain although I have no evidence,” avoidance of cue gathering), an immediate pivot<sup>3</sup> is needed to context work. For this, re-narrate the same scene from a third-person vantage, list external cues about the situation/actors/environment, and practice tolerating ambiguity (brief exposure to ambiguous stimuli) to interrupt over-trust

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<sup>2</sup> Micro-cycle → reflective equilibration loop: a short, repeated sequence—check confidence; generate two or three alternatives; contrast key evidence (for/against); reweight contextual cues; recalibrate confidence—used as an operational principle to synchronize metacognitive feelings (confidence, fluency, effort) with explicit reasoning on the same time axis during sessions.

<sup>3</sup> Pivot → rebalancing move: a within-session control procedure that, when imbalance signals—over-internalization or over-externalization—are detected, immediately switches the rule-set between self- and context-work to recenter the trajectory within the *adaptive corridor*; it may be invoked from any step of the micro-cycle (triggers: over-internalization → context-work [*Pivot A*]; over-externalization → self-work [*Pivot B*]).

in procedural signals and re-inject external information. Conversely, when over-externalization is prominent (hyper-mentalizing others' intentions, over-inference, automatic "feeling = fact"), a pivot to self-work is needed. Pivot A/B (rebalancing moves) are not aimed at restructuring belief content; rather, they respond to imbalance signals detected *via* metacognitive feelings (confidence, fluency, effort) and reweight the two axes on a short time scale [17, 18].

Accordingly, affect-thought separation and one–two self-guidance sentences are used not to install a new interpretation but to stop-check-shift the automatic judgment stream as an operational step. Likewise, a confidence-evidence mismatch is not marked as proof for or against a belief, but as a calibration point for synchronizing procedural signals and explicit reasoning on the same time axis. In sum, these pivot triggers implement Proust's view, namely that procedural (feeling-based) control and explicit (language/reasoning-based) control must operate concurrently and cross-correct at the session management level [17, 18, 20]. Unlike the content-focused restructuring of CBT, this perspective engages in reweighting to restore balance and uses short reflective equilibration loops as the primary means for concurrent co-regulation.

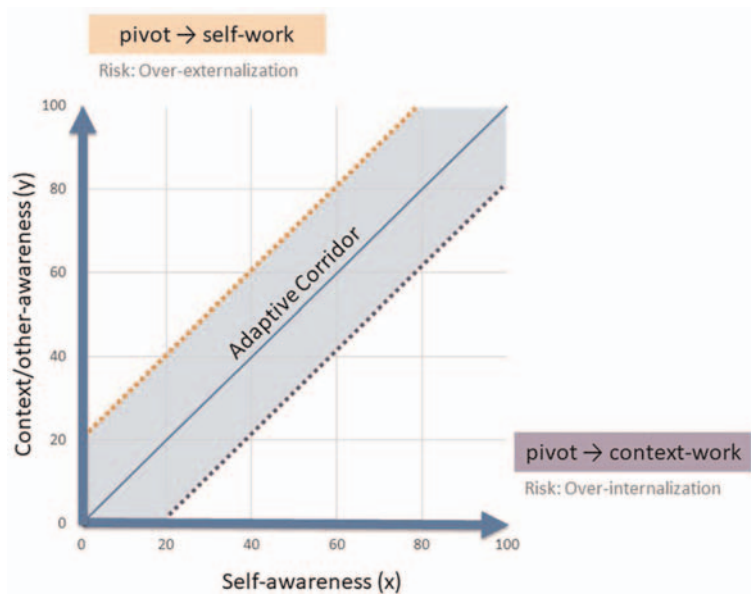
Minimal evaluation suffices. First, confidence-outcome congruence must be tracked by comparing post-judgment confidence ratings with subsequent outcomes or evidence (a quick diary). Second, tolerance of ambiguity must be recorded by noting the time or intensity spent with ambiguous facial, verbal, or situational stimuli. Even these two indices can visualize the effects of concurrent balancing while keeping measurement burden low, consistent with the emphasis of MCI-S on real-life generalization [16].

In sum, this shift preserves the strengths of MCI-S (reduced delusions; improved social cognition and social functioning) while addressing gating and desynchrony introduced by strict sequentiality. Short, iterative co-regulation within sessions aligns procedural signals and explicit reasoning on the same time axis, promoting carry-over and generalization and broadening therapeutic flexibility.

*Summary.* Metacognitive components function more like a bidirectional network than a linear staircase. Strict staging can hamper therapeutic agility and in some patients, entrench internal/external tilts. Hence, a balance-oriented design centered on the concurrent coordination of procedural and explicit metacognition is warranted.

### 3. Need for a balance-oriented framework

In general psychology and personality theory, a cognitive referencing system that tilts toward either an internal (self-reflective) or an external (context/other-oriented) anchor is prone to systematic distortions in perception and interpretation. A balance-oriented perspective treats metacognition not as a fixed staircase but as a dynamic regulator moving between two axes—self-awareness and context/other-awareness—to enable early detection and adjustment of imbalances. **Figure 2** illustrates this perspective as a conceptual map with self-awareness on the x-axis and context/other-awareness on the y-axis. A diagonal "adaptive corridor" indicates balanced co-regulation, with a pivot to self-work at the upper left and to context-work at the lower right. The author provisionally refers to this as the *Metacognitive Balance Theory* (working name);



**Figure 2.**

*Balance-oriented perspective (conceptual map): the axes represent self-awareness ( $x$ ) and context/other-awareness ( $y$ ); the shaded diagonal band around  $y = x$  marks the adaptive corridor (balanced co-regulation), and arrows indicate pivots toward self-work (upper-left) and context work (lower-right).*

hereafter, the balance-oriented perspective. Details of the formal specification and its empirical evaluation are reserved for a separate peer-reviewed article.

This vantage also aligns with Jung’s introversion-extraversion distinction [23]: Excessive introversion can narrow attention inward, fostering rumination and self-reproach, whereas excessive extraversion can over-rely on external stimuli and interpersonal cues, risking over-interpretation and persecutory inferences. Whereas Jung’s typology primarily accounts for relatively stable attitudinal preferences, the balance-oriented perspective emphasizes a regulatory mechanism that detects whether appraisal leans toward internal versus external anchors and dynamically reweights the emphasis to fit the situation.

First, the balance-oriented perspective redefines the goal of metacognition from strengthening a single function to mutual constraint and cooperation between the axes. In practice, the approach posits an adaptive corridor and uses real-time micro-adjustments to prevent drifts toward either extreme—over-internalization, characterized by rumination, self-blame, and mistaking fluency for validity; and over-externalization, characterized by over-interpretation, over-inference, and the “feeling = fact” shortcut. This presupposes the concurrent operation of procedural signal calibration (confidence/effort/fluency) and explicit reasoning (alternative generation, evidence contrast) [17, 18, 20].

Second, the balance-oriented perspective assumes temporal multilayering. Within sessions, the aforementioned micro-cycle executes immediate corrections. Between sessions, the person’s baseline tilt (set-point) and regulatory gain (e.g., how quickly confidence spikes and how long one tolerates ambiguity) are gradually recalibrated. Furthermore, in daily life (home, work, community), the same principles generalize across tasks, relationships, and roles, strengthening every-day self-regulation.

Third, the perspective clarifies the following core control parameters: (1) confidence gain—the rate at which confidence rises relative to evidence, (2) ambiguity threshold—the minimum time or intensity one can remain with ambiguous stimuli, (3) cue weighting—relative allocation to internal versus external cues, and (4) switch sensitivity—the ease stop-check-shift routines can be invoked. Clinicians address these with brief verbalization and exercises, applying immediate pivot triggers (over-internalization → context work; over-externalization → self-work) as needed.

Fourth, the perspective facilitates individualization. Personality propensities (e.g., anxiety proneness and social sensitivity) and state factors (sleep, stress, side effects of medication) alter baseline tilts and thresholds. For this, begin with minimal indices, namely confidence-outcome congruence and tolerance of ambiguity, and then add optional auxiliaries (cue-utilization ratio, JTC tendency) to update a personal balance map.

The clinical implications are clear. A balance-oriented perspective helps detect imbalance at the early signal stage before distortions consolidate. Short loops and immediate pivots rapidly buffer over-internalization and over-externalization. Essentially, reframing metacognition not as a linear hierarchy, but as a co-regulatory system in which inner and outer processes reciprocally respond promotes the carry-over and generalization of skills and makes session design more agile. On this basis, the next section outlines design principles for balance-oriented interventions and directions for further refinement (e.g., standardizing balance indices and quantitative thresholds for pivot triggers).

*Summary.* The balance-oriented perspective recasts metacognition as a *dynamic co-regulation* between self- and context/other-awareness. Early detection of the internal/external tilt is followed by corrections *via micro-cycles* and *instant pivots*. Tracking *minimal indices* (confidence-outcome congruence, tolerance of ambiguity) enhances generalization and therapeutic flexibility.

#### 4. Emerging conceptual directions: A balance-oriented perspective

As argued above, the core of intervention in schizophrenia lies in the concurrent co-regulation of self-awareness and context/other-awareness, rather than in deciding what to do first. To organize the discussion, this chapter adopts the balance-oriented perspective. This perspective treats metacognition not as a stepwise hierarchy but as an interactive two-axis control system (self/context). It restores balance by buffering the extremes of over-internalization and over-externalization in clinical and educational settings.

Within this perspective, the goal of metacognition is not to increase a single function, but to restore and maintain balance by regulating both axes at the same time. Concretely, it aligns and calibrates metacognitive feeling-signals—how sure it feels (confidence), how easily it comes to mind (fluency), and how much mental work it takes (effort)—with explicit metacognitive work—generating alternatives, weighing supporting and opposing evidence, and shifting to a third-person perspective—on the same time axis.

The core ideas can be summarized as follows. Within a session, self- and context/other-awareness are co-regulated (concurrency), and brief micro-cycles—on the order of 30–180 s—may be used. A typical cycle might proceed as follows: check confidence → generate alternatives → examine key evidence → reweight contextual cues → recalibrate confidence. The aim is to align procedural signals (confidence, fluency,

effort) with explicit reasoning (alternative generation, evidence contrast, perspective shift) on the same time axis. When signs of imbalance appear (over-internalization or over-externalization), the focus pivots as appropriate—toward context-work for the former and toward self-work for the latter. Rather than prioritizing content restructuring as in CBT, this loop is built to reweight the self and context axes to restore balance. It can be inserted briefly and often into ongoing treatments such as CBT, SCIT, MCT, or MERIT—inline within an activity, as a bookend at the start or end of a session, or on-demand when a signal appears—without carving the work into large blocks. Evaluation is intentionally minimal; we track confidence-outcome congruence and tolerance of ambiguity. The approach runs on three time scales: immediate in-session corrections; between-session recalibration of the control-theoretic set point and gain; and generalization and carry-over to daily contexts.

#### **4.1 Scope note**

In this chapter, the balance-oriented perspective is presented only as a conceptual perspective, and the summary focuses on operational principles and points of application that clinicians and educators can use immediately—micro-cycles, pivot triggers, and minimal indices. We also make explicit that immediate effects observed right after an intervention do not, by themselves, constitute enduring improvements in metacognitive ability. Metacognitive change is gradually internalized over time through learning, reflection, and everyday transfer.

#### **4.2 Temporality of metacognitive change**

Metacognition—especially balance regulation—is typically not “enabled” by a single session; rather, it is gradually internalized through a sequence of intervention → reflection → reattempt → real-world transfer. Accordingly, the balance-oriented operation proposed here uses a brief in-session micro-cycle as a catalyst, and recommends a post-session reflective consolidation process to calibrate, over time, the alignment between procedural signals (confidence, fluency, effort) and explicit reasoning. In short, the micro-cycle supports immediate in-session adjustment, while a reflective-consolidation loop extends calibration across the time axis after the session.

This is not the one-off effect of a technique. It presupposes temporal multilayering—within session, between sessions, and in everyday contexts—aimed at the internalization of balance.

#### **4.3 Practical applications**

The following applications are highlighted in clinical and educational settings:

- Clinical: Insert micro-cycles into each case discussion or role-play to co-deliver confidence calibration and context integration. Pivot as appropriate when internal/external over-tilt appears.
- Education/training: During tasks, emphasize awareness of confidence-evidence mismatches and cue utilization, thereby facilitating carry-over.
- Integrated use: Interleave balance-oriented micro-cycles between modules of MCI-S, SCIT, and CBT-based trainings to increase agility.

*Summary. The balance-oriented perspective reconceives metacognition as simultaneous, reciprocal regulation along two axes (self and context). This chapter delineates its core premises and operational principles to enable practical use in clinical and educational contexts.*

5. Implications for clinical and educational settings

This section develops the operational side of the framework through clinical and educational examples and specifies minimal indices and documentation tools (Table 2), while also providing a one-page micro-cycle checklist (Box 1).

| Index                         | Definition/focus                                                                                     | In-session notation (example)                                                                                  | Interpretation hints                                            |
|-------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Confidence-outcome congruence | Confidence rating given immediately after a judgment vs. degree of evidential support verified later | “Event [event name]: confidence 8/10 → actual evidence 5/10”<br>e.g., “Event [team presentation]: 8/10 → 5/10” | Persistent overconfidence → suspect internal excess             |
| Tolerance of ambiguity        | Time/intensity spent staying with an ambiguous stimulus                                              | “Facial expression/sentence [item]: maintained for 45 s,”<br>e.g., “Facial expression [frown]: 45 s”           | Low scores → external avoidance/jumping-to-conclusions tendency |

Note: Words inside [ ] brackets are placeholders to be replaced with actual examples (e.g., [event name] → team presentation; [item] → “He ignored me”)/Keep entries brief (1–2 lines). Track trends with only the two low-burden indices: confidence-outcome congruence and tolerance of ambiguity.

Table 2.  
Minimal indices and worksheet (summary).

Micro-cycle quick checklist (30–180 s)

1. Confidence (0–10) + state label: \_\_\_\_

2. Two alternatives: (A) \_\_\_\_ (B) \_\_\_\_

3. Key evidence—for \_\_\_\_/against \_\_\_\_

4. Context cues added/reweighted: \_\_\_\_

5. Recalibrated confidence (0–10) and one-line reason: \_\_\_\_

If drift: Pivot A ☐ / Pivot B ☐

Indices: C-O congruence\* ☐ | Tolerance of ambiguity (sec): \_\_\_\_

\* C-O congruence: Confidence-Outcome congruence.

Box 1.  
Micro-cycle quick checklist (30–180 s).

5.1 Clinical

The balance-oriented perspective streamlines the entire assessment-intervention--documentation chain. To this end, first, conduct an initial screening of internal/

external tilt (e.g., self-centric thinking and over-dependence on others/situational cues) to estimate baseline tilt and switch sensitivity. Second, in each session, insert brief micro-cycles into case discussions or role-plays to synchronize procedural signals (confidence, fluency, effort) with explicit reasoning on the same timeline. Third, apply pivot triggers to address imbalance promptly: for over-internalization, strengthen context work (third-person re-narration, cue listing, ambiguity tolerance). For over-externalization, re-activate self-work (affect-thought separation, 1–2 self-guidance sentences, probing confidence-evidence mismatches). Fourth, end sessions by briefly documenting minimal indices (confidence-outcome congruence; tolerance of ambiguity) to track the direction of change. This approach facilitates instant corrections within sessions, a recalibration of set-point or gain across sessions, and generalization to everyday contexts. See **Box 2** for the step-by-step workflow.

*Objectives:* Apply the balance-oriented perspective in routine visits; minimize cognitive load; log two minimal indices.

*Workflow (one brief micro-cycle; 30–180 s):*

1. Check confidence (0–10) and add a one-line state label.
2. Generate two alternatives.
3. Examine key evidence (for/against).
4. Reweight context cues (third-person view; cue list; tolerate ambiguity 30–60 s).
5. Recalibrate confidence and record a one-line reason.

*Pivot triggers:*

- Over-internalization → *Pivot A (context-work)*: third-person reframing; cue listing; tolerate ambiguity.
- Over-externalization → *Pivot B (self-work)*: separate emotion vs. thought; self-guidance note; check confidence-evidence mismatch.

*Clinical vignette (6–8 turns):*

Patient: “They laughed at me.” Confidence 8/10; label “targeted.”

Therapist: “Name two other explanations.” → “They were joking with each other; maybe a video.”

“What did you actually observe? What would count against your reading?”

List context cues (distance, eye contact, prior events) → Recalibrate 8 → 4/10; reason logged.

*Minimal indices:* Confidence-outcome congruence (24–72 h follow-up) and tolerance of ambiguity (time sustained).

### **Box 2.**

*Clinical micro-cycle: objectives and workflow (30–180 s).*

## **5.2 Education/training**

Tasks should be designed so that learners co-recruit self-reflection and context interpretation. For example, pre-activity confidence ratings should be obtained before presentations or discussions, and evidence-based self-appraisals should be conducted afterward to examine confidence-evidence mismatches. Furthermore, peer feedback should be structured around third-person framing and context cue discovery to buffer

polarization (over-internalization/over-externalization), thereby reducing rigidity and fostering integrative cognitive development and social interaction skills. See **Box 3** for the classroom routine and prompts.

*Setting:* Simulation debrief or skills lab; three micro-cycles per student ( $\approx 90$  s each).

*Routine:*

(1) Confidence (0–10) + state label  $\rightarrow$  (2) Two alternatives  $\rightarrow$  (3) Key evidence (for/against)  $\rightarrow$  (4) Context-cue reweighting  $\rightarrow$  (5) Recalibration + one-line reason.

*Instructor prompts:* Trigger *Pivot A* on self-blame/rumination; trigger *Pivot B* when others' reactions dominate weak evidence.

*Recording:* One-page card per cycle; end-of-class summary shows *largest confidence drop* and *best new cue*.

*Assessment:* Two indices only (confidence-outcome congruence; tolerance of ambiguity). Optional: JTC checklist (Y/N).

### **Box 3.**

*Educational micro-cycles: routine and prompts.*

## **5.3 Quality management and documentation**

To reduce implementation burden, start with two minimal indices:

1. Confidence-outcome congruence—compare post-judgment confidence with later outcomes or evidence to gauge calibration of procedural signals.
2. Tolerance of ambiguity—log the time or intensity a person can stay with ambiguous stimuli to track reduced avoidance and increased receptivity to context. Auxiliary indices (e.g., cue-utilization ratio and JTC tendency) can be added selectively to update the personal balance map (**Table 2**) and (**Box 1**).

## **5.4 Implementation notes**

In acute or high-load situations, cap the number of alternative hypotheses at 1–2 and reduce evidence rules to one to manage cognitive load. To prevent over-reflection drifting into rumination, impose time limits and behavioral switch cues on self-work. Where affective arousal is high or delusional ideation is suspected to escalate, prioritize stabilization or reality testing over balance training.

## **5.5 Future directions**

To extend this conceptual framework into empirical grounding, priorities include: (1) development or validation of standardized checklists and worksheets, (2) reliability or sensitivity testing of minimal indices, and (3) integrated protocols with existing programs (MCI-S, SCIT, and CBT-based trainings) and outcome-based evaluation. These efforts will consolidate the balance-oriented perspective as a measurable and trainable operational principle.

## **6. Conclusions**

This chapter critically reviewed the limitations of sequential metacognitive intervention models (e.g., MCI-S) and argued for the need for a balance-oriented

perspective grounded in the concurrent coordination of self-awareness and context/other-awareness. Drawing on personality theory and general psychology, it emphasized that metacognitive imbalance may amplify cognitive distortions and functional impairments in schizophrenia. The balance advanced here is offered as a conceptual direction rather than a formal model; it calls for subsequent systematic elaboration and empirical validation, and its validity should be examined—particularly within clinical and educational interventions—to better support cognitive and social functioning.

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## **Conflict of interest**

The authors declare no conflict of interest.

## **Author details**

Mihwa Han<sup>1\*</sup> and Hoedeok Gu<sup>2</sup>

1 Department of Nursing, Sunlin University, Pohang-si, Gyeongbuk, Republic of Korea

2 Department of Psychiatry, Gyeongsangbuk-do Provincial Pohang Medical Center, Pohang-si, Gyeongbuk, Republic of Korea

\*Address all correspondence to: mihwahanrn@sunlin.ac.kr

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