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Developing Critical Thinking and Decision-Making Through Problem-Solving Strategies: A Literature-Based Review

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Abstract
Critical thinking, problem solving, and decision making are increasingly recognized as essential competencies in contemporary education. These skills enable learners not only to acquire knowledge but also to analyse information, evaluate evidence, generate possible solutions, make reasoned judgments, and apply knowledge to complex situations. This literature-based review examines the relationship between critical thinking and decision-making and explores how problem-solving strategies can contribute to their development. The literature indicates that problem-solving-oriented approaches, particularly problem-based learning, collaborative problem solving, inquiry-based learning, and metacognitive strategies, can provide learners with opportunities to engage in analysis, evaluation, reasoning, reflection, and judgment. Research also suggests that metacognitive processes such as planning, monitoring, and evaluating one's own thinking are particularly important because they help learners become aware of how they approach problems and why they select particular solutions. Effective implementation requires appropriately challenging problems, explicit instruction, teacher scaffolding, opportunities for discussion and reflection, and assessment practices that emphasize reasoning rather than only correct answers. The review concludes that problem solving can serve as an important pedagogical pathway for integrating critical thinking and decision making into teaching and learning.
Keywords: Critical thinking, Decision making, Problem solving, Metacognition, Higher-order thinking.

1. Introduction

Education in the twenty-first century increasingly emphasizes competencies that extend beyond the memorization and reproduction of information. Among these competencies, critical thinking, problem solving, and decision making have received considerable attention because of their relevance to academic learning, professional practice, and everyday life. Students are increasingly expected to interpret information, identify problems, evaluate alternatives, justify conclusions, and make appropriate decisions in situations characterized by complexity and uncertainty. Critical thinking involves purposeful and reflective thinking that enables individuals to analyze information, evaluate evidence, examine assumptions, make inferences, and reach justified conclusions (Facione, 1990). It is therefore closely connected to problem solving and decision making, as effective problem solving requires individuals to apply reasoning and judgment when considering possible solutions and selecting appropriate courses of action.

Problem solving provides a practical context in which critical-thinking processes can be developed. When students encounter an authentic or complex problem, they must

first understand the nature of the problem, identify relevant information, consider possible explanations or solutions, evaluate alternatives, and determine an appropriate course of action. These processes require learners to move beyond the simple recall of knowledge and engage in higher-order cognitive activities such as analysis, evaluation, inference, and reflection (Liu & Pásztor, 2022). In this sense, problem-solving activities can transform critical thinking from an abstract cognitive ability into a practical process through which students apply reasoning to meaningful and challenging situations. Furthermore, opportunities to reflect on the strategies used to solve problems can strengthen students' awareness of their own thinking and support the development of metacognitive regulation

Problem-based learning (PBL) is one of the most frequently discussed pedagogical approaches for developing these abilities. PBL engages students in complex and meaningful problems that require them to investigate issues, identify relevant information, discuss possible explanations, evaluate evidence, and develop appropriate solutions (Facione, 1990). These characteristics create opportunities for students to practice critical thinking while simultaneously developing problem-solving and decision-making skills (Liu & Pásztor, 2022).

However, the effectiveness of PBL and other problem-solving approaches should not be assumed to occur automatically. Evidence suggests that the impact of PBL can vary according to factors such as instructional design, student characteristics, group size, discipline, duration of the intervention, and the role of the teacher (Liu & Pásztor, 2022). Effective implementation therefore requires appropriately designed problems, opportunities for collaboration and discussion, teacher guidance, feedback, and reflection. These conditions can help students engage more deeply with problems and make more reasoned judgments rather than simply searching for predetermined answers. In addition, research has indicated that the effects of PBL are not always consistent across educational contexts, highlighting the importance of examining how and under what conditions problem-solving strategies contribute to higher-order thinking (Benarose & Hmouma, 2026).

Therefore, this literature-based review examines how problem-solving strategies can contribute to the development of critical thinking and decision-making. Particular attention is given to the cognitive processes involved in problem solving, the role of problem-based learning in promoting higher-order thinking, and the pedagogical conditions that can make problem-solving strategies more effective. By examining these relationships, the review aims to clarify how educators can deliberately use problem-solving activities to support students in becoming more analytical, reflective, and effective decision makers.

2. Critical Thinking, Problem Solving, and Decision Making

Although critical thinking, problem solving, and decision making are distinct concepts, they are closely interconnected cognitive processes. Critical thinking can be understood as purposeful and reflective thinking that involves analysis, evaluation, inference, reasoning, and self-regulation (Facione, 1990). It requires learners to question assumptions, distinguish relevant from irrelevant information, evaluate the credibility and quality of evidence, consider alternative perspectives, and construct justified conclusions. Problem solving, in contrast, refers to the process of identifying a gap

between a current state and a desired outcome and determining ways to overcome that gap. Effective problem solving commonly involves identifying and defining the problem, gathering relevant information, generating possible solutions, evaluating alternatives, implementing a selected solution, and reflecting on the outcome (Hmouma, 2024a).

Decision making involves selecting among available alternatives and determining an appropriate course of action. Effective decision making requires individuals to consider evidence, potential consequences, advantages and disadvantages, risks, and limitations before selecting an alternative (Jonassen, 2000). Decision making is therefore closely related to critical thinking because the quality of a decision depends partly on the ability to evaluate information and alternatives systematically (Halpern, 1998). While problem solving focuses primarily on addressing a problem and developing possible solutions, decision making focuses on selecting the most appropriate option among those alternatives.

These processes can therefore be conceptualized as interconnected: Problem; Analysis; Evaluation of alternatives; Decision; Action; and Reflection. Within this sequence, critical thinking provides many of the cognitive processes needed to understand and analyze the problem, evaluate information, compare alternatives, and justify conclusions (Klella & Al Garaghoolee, 2026). Problem solving provides the context in which these processes are applied, while decision making represents an important point at which reasoning is translated into action. Reflection following action can then provide an opportunity to evaluate the effectiveness of the decision and reconsider the reasoning used (Anggraeni et al., 2023). This interconnected relationship suggests that developing students' critical-thinking abilities may also contribute to their capacity to solve problems and make reasoned decisions.

Research has increasingly emphasized the relationship among these skills. A recent study of primary school students found that problem-solving and decision-making skills were associated with the relationship between critical-thinking dispositions and students' perceptions of success, suggesting that these cognitive abilities may operate together rather than as completely independent competencies (Çeviker Ay & Saka, 2024). The relationship is particularly relevant in educational contexts because students frequently encounter situations in which they must interpret information, identify a problem, consider possible solutions, and select an appropriate response (Hmouma, 2024b). Developing these skills together may therefore provide students with a more comprehensive set of cognitive tools for dealing with complex academic and real-world situations.

3. Problem-Solving Strategies as a Pathway to Critical Thinking

One of the central arguments in the literature is that critical thinking is more effectively developed when students are required to apply it while addressing meaningful problems rather than simply learning definitions or characteristics of critical-thinking skills (Hmelo-Silver, 2004). Learning environments that require students to investigate problems, evaluate information, compare alternatives, and justify their conclusions can provide opportunities for the repeated practice of higher-order thinking

PBL provides an important example of this approach. In PBL, students encounter a complex problem, case, or scenario that requires investigation and reasoning. Rather than receiving all relevant information directly from the teacher, students identify what they need to know, gather and evaluate information, discuss possible explanations, consider alternative solutions, and construct responses to the problem (Liu & Pásztor, 2022). The teacher typically acts as a facilitator who guides students' inquiry rather than simply providing the solution. Through this process, students are encouraged to take greater responsibility for their learning while engaging in cognitive activities associated with critical thinking.

Evidence from the literature supports the potential of PBL to promote critical thinking. A meta-analysis examining PBL in higher education found a positive overall effect of PBL on critical thinking, including both critical-thinking skills and dispositions (Liu & Pásztor, 2022). Similarly, a systematic review concluded that PBL can foster critical-thinking skills by placing students in learning situations that require active engagement with problems, information, reasoning, and solutions (Anggraeni et al., 2023). These findings suggest that the problem-solving process can serve as a pathway through which students repeatedly practice the cognitive operations involved in critical thinking.

However, problem-solving alone is not necessarily sufficient to develop critical thinking. The quality and cognitive demands of the problem-solving activity are important. If students are simply required to follow predetermined procedures or reproduce an expected answer, the activity may provide limited opportunities for higher-order thinking (Jonassen, 2000; Liu & Pásztor, 2022). In contrast, problems that have multiple possible solutions or require students to interpret incomplete or conflicting information can encourage deeper analysis and evaluation. Students should therefore be encouraged to explain why they believe a particular solution is appropriate, compare competing explanations, question assumptions, evaluate evidence, and justify their decisions

The role of reflection is also particularly important. After developing or implementing a solution, students can be asked to examine the reasoning that led to their decision, evaluate whether the solution was effective, identify weaknesses in their approach, and consider how they might respond differently to a similar problem in the future (Manuaba et al., 2022). Such reflection encourages metacognitive regulation and can help students become more aware of how they think and make decisions (Facione, 1990). Therefore, problem-solving strategies are most likely to contribute to critical thinking when they are deliberately designed to require analysis, evaluation, justification, and reflection rather than merely the completion of a task.

4. Collaborative Problem Solving

Collaboration can further strengthen the relationship between problem solving and critical thinking. When students work together on complex problems, they encounter perspectives, interpretations, and proposed solutions that may differ from their own. This creates opportunities for explanation, argumentation, questioning, negotiation, and evaluation (Klella, 2026). Through interaction with peers, students are required to explain their reasoning, respond to alternative viewpoints, reconsider assumptions, and provide evidence to support their conclusions. Collaborative learning can therefore

create a social context in which critical-thinking processes are practiced and developed through dialogue and shared problem solving.

Research has provided evidence for the potential of collaborative problem solving to promote higher-order thinking. A meta-analysis examining collaborative problem-solving interventions found positive effects on students' problem-solving performance and related cognitive outcomes, highlighting the importance of structured interaction and shared reasoning during problem-solving activities (Schoenfeld et al., 2023). However, collaboration does not automatically result in effective critical thinking. The quality of interaction among students is important. Tasks need to encourage students to explain their reasoning, challenge ideas respectfully, evaluate evidence, and reach conclusions through discussion rather than simply dividing the work among group members (Hmouma et al., 2026).

Collaborative problem solving can therefore be structured around questions that encourage students to examine both the problem and their reasoning. For example, students can be guided to ask:

- What exactly is the problem?
- What information do we already have?
- What information is missing?
- What assumptions are we making?
- What possible solutions can we generate?
- What evidence supports each solution?
- What are the advantages and disadvantages of each alternative?
- Which solution is most appropriate, and why?
- What might happen if our decision is wrong?

Such questions move students beyond simply producing an answer. They require students to explain and defend the reasoning that led to the answer, evaluate alternative perspectives, and consider the evidence supporting different courses of action (Klella, 2024). In this way, collaborative problem solving can connect problem identification, critical evaluation, decision making, and reflection within a single learning activity (Hmelo-Silver, 2004). The interaction between students can also expose weaknesses in individual reasoning and encourage learners to reconsider conclusions when presented with convincing evidence or alternative explanations.

5. Metacognition and Reflective Problem Solving

Another important component of effective problem solving is metacognition. Metacognition refers broadly to learners' awareness and regulation of their own thinking. It commonly includes processes such as planning, monitoring, and evaluating cognitive activity (Flavell, 1979; Schraw & Moshman, 1995). Metacognition is particularly relevant to problem solving because students may possess appropriate cognitive strategies but fail to recognize when or how those strategies should be applied. Teaching students to monitor their reasoning can therefore make problem solving more deliberate, controlled, and reflective.

Metacognitive strategies are closely related to critical thinking because both involve monitoring and evaluating the quality of one's reasoning (Zohar & Barzilai, 2013).

Students who engage in metacognitive regulation are encouraged to consider whether they understand the problem, whether the evidence they are using is reliable, whether their strategy is effective, and whether their conclusions are adequately supported. These processes can help students identify errors in their reasoning and make appropriate adjustments during problem solving (Schraw & Moshman, 1995). In this respect, metacognition provides a mechanism through which students can become more aware of not only what they think but also how and why they reach particular conclusions.

Problem-based learning can provide a useful environment for developing these abilities because students must investigate, interpret information, reason about possible explanations, make decisions, and reflect on their solutions (Ibrahim et al., 2026). Research on PBL has emphasized the importance of reflection and self-directed learning in supporting students' higher-order cognitive development (Hmelo-Silver, 2004). Similarly, research on metacognitive strategies suggests that explicit instruction in planning, monitoring, and evaluation can support students' learning and their ability to regulate complex cognitive tasks.

A practical problem-solving cycle can therefore incorporate three stages of metacognitive questioning:

Before solving:

- What do I know?
- What do I need to know?
- What strategy should I use?

During solving:

- Am I making progress?
- Is my evidence reliable?
- Does my strategy seem to be working?
- Do I need to change my approach?

After solving:

- Was my solution appropriate?
- What evidence supports my decision?
- What were the strengths and weaknesses of my approach?
- What would I do differently next time?

This process encourages students not only to solve problems but also to understand how they solve problems. Planning helps students determine an appropriate approach before beginning the task, monitoring allows them to identify difficulties and adjust their strategies during the process, and evaluation enables them to judge the quality of their solution and reasoning after completing the task (Klella & Mrghem, 2024). Consequently, metacognitive regulation can strengthen the connection between problem solving and critical thinking by encouraging students to examine, control, and improve their own reasoning processes.

6. Decision Making Through Problem Solving

Decision making can be developed when students are required to choose among multiple possible solutions rather than simply identify one predetermined correct answer. Traditional classroom exercises often provide students with clearly defined problems and expected answers (Jonassen, 2000). In contrast, authentic and complex problems may involve incomplete information, competing priorities, uncertainty, and multiple reasonable solutions. These conditions require students to evaluate alternatives, consider potential consequences, and make judgments based on available evidence.

Problem-solving activities can therefore be designed to explicitly incorporate decision-making processes. For example, rather than asking students to identify a single factual answer, an instructor can present a realistic situation in which several possible actions are available. Students can then be required to:

1. Define the problem.
2. Identify the relevant evidence.
3. Generate alternative solutions.
4. Establish criteria for evaluating the alternatives.
5. Compare the alternatives.
6. Predict possible consequences.
7. Select and justify a decision.
8. Reflect on the quality of the decision.

This approach connects critical thinking directly with decision making. Students must analyze information, evaluate evidence, compare alternatives, consider consequences, and justify their final choice. The process also encourages students to recognize that decision making is not simply about selecting an answer but about constructing a reasoned judgment based on available evidence and clearly defined criteria (Karrar et al., 2026).

Importantly, the quality of a decision should not be judged only by whether students select the teacher's preferred answer. Assessment should also examine the reasoning behind the decision, the quality and relevance of the evidence used, consideration of alternative solutions, recognition of limitations and uncertainty, and the ability to justify the final choice (Halpern, 1998). Such an approach places greater emphasis on the quality of students' thinking rather than on whether they happen to reach a predetermined conclusion. It also reflects the nature of authentic decision making, in which individuals frequently have to make judgments without having access to a single objectively correct answer.

7. Instructional Strategies for Developing Critical Thinking Through Problem Solving

The literature suggests several instructional strategies that teachers can integrate into classroom practice to create opportunities for students to develop critical thinking through problem solving. Although these approaches differ in their structure and emphasis, they share a common focus on active engagement, reasoning, evaluation, and reflection.

7.1 Problem-Based Learning

PBL places students at the center of the learning process and uses problems as a starting point for investigation. Students are presented with complex problems that require them to identify what they know, determine what they need to learn, gather relevant information, evaluate possible explanations, and develop solutions (Hmelo-Silver, 2004). Rather than simply receiving information from the teacher, students actively construct knowledge while working through the problem.

Research provides substantial support for the potential of appropriately designed PBL to develop critical thinking. A meta-analysis of PBL in higher education found a positive overall effect on students' critical thinking, including both critical-thinking skills and dispositions (Liu & Pásztor, 2022). Similarly, a systematic review found that PBL can foster critical thinking by engaging students in activities that require analysis, evaluation, reasoning, and the application of knowledge to complex problems (Anggraeni et al., 2023). However, the effectiveness of PBL depends on factors such as the quality of the problems, instructional design, teacher facilitation, and opportunities for reflection.

7.2 Inquiry-Based Learning

Inquiry-based learning encourages students to formulate questions, investigate evidence, develop explanations, and evaluate conclusions. Instead of receiving knowledge as fixed information, students participate in processes of questioning and investigation (Liu & Pásztor, 2022). This can support critical thinking because students must determine what information is relevant, assess evidence, consider competing explanations, and draw conclusions based on their findings (Hmelo-Silver et al., 2007). Inquiry activities can be particularly effective when students are encouraged to explain how they reached their conclusions rather than simply provide an answer (Mrghem & Klella, 2026). Teachers can ask students to identify the evidence supporting their explanation, consider alternative interpretations, and determine whether additional information is required. Such practices can strengthen the analytical and evaluative dimensions of critical thinking.

7.3 Case-Based Learning

Case-based learning allows students to examine realistic situations involving complex problems, competing explanations, or difficult decisions. Students can analyze the case, identify the central problem, evaluate relevant evidence, consider different perspectives, and recommend a course of action. Because cases often contain incomplete information and more than one possible response, they can provide meaningful opportunities for students to practice judgment and decision-making (Anggraeni et al., 2023). Case-based activities can also help students connect theoretical knowledge with practical situations. Rather than learning concepts in isolation, students are required to apply them to specific circumstances and explain how the available evidence supports their proposed solution. This application of knowledge can encourage deeper reasoning and evaluation.

7.4 Collaborative Problem Solving

Students can work in small groups to identify problems, generate possible solutions, evaluate alternatives, and reach shared decisions. Collaborative problem solving exposes students to different perspectives and requires them to explain and defend their reasoning. When students encounter disagreement, they must evaluate competing arguments and determine which position is better supported by evidence (Hmelo-Silver, 2004). Teachers can strengthen this process by asking students to justify their contributions, question assumptions, respond to alternative viewpoints, and explain why one solution is preferable to another. In this way, collaboration can create a social environment in which critical-thinking processes are practiced through dialogue and shared reasoning

7.5 Metacognitive Questioning

Teachers can explicitly teach students to monitor and evaluate their own thinking through metacognitive questions. Examples include:

- Why do I believe this?
- What evidence supports my conclusion?
- What assumptions am I making?
- Is there another explanation?
- Have I considered alternative solutions?
- How confident am I in this decision?
- What evidence would change my conclusion?

Such questions encourage students to examine the reasoning underlying their judgments rather than accepting their initial conclusions without evaluation (Schraw & Moshman, 1995). Metacognitive questioning can therefore help students become more aware of their reasoning processes and identify weaknesses in their thinking.

7.6 Reflection

Reflection should occur after students have attempted to solve a problem or make a decision. Students can be asked to analyze the strategy they used, explain why they selected a particular solution, identify difficulties they encountered, evaluate the evidence they considered, and determine what they would change in a future situation. Reflection can help students evaluate not only the outcome of their problem solving but also the reasoning process that produced the outcome (Facione, 1990; Schraw & Moshman, 1995). This reflective stage is particularly important because students may otherwise complete a problem-solving task without considering whether their approach was effective or whether another strategy might have produced a better result. By deliberately incorporating reflection, teachers can encourage students to learn from both successful and unsuccessful attempts and gradually improve their ability to approach complex problems and decisions.

8. The Role of the Teacher

The development of critical thinking through problem solving does not mean that teachers should simply present difficult problems and allow students to work independently. Although student autonomy is an important feature of problem-based and inquiry-oriented learning, teacher guidance remains essential for helping students

engage productively with complex tasks (Hmelo-Silver et al., 2007). Teachers can function as facilitators who structure meaningful problems, ask probing questions, provide appropriate scaffolding, challenge unsupported assumptions, and encourage students to justify their conclusions (Hmelo-Silver, 2004). Effective teacher guidance is particularly important when students are unfamiliar with problem-based learning or lack sufficient background knowledge to approach complex problems independently. Without appropriate support, students may focus on finding a quick answer rather than examining evidence, comparing alternatives, or evaluating the quality of their reasoning. Scaffolding can help students understand the problem-solving process while gradually encouraging greater independence and responsibility for their own thinking

The teacher can also promote critical thinking by asking questions that require students to explain and defend their reasoning. For example, questions such as *What evidence supports your conclusion? What assumptions are you making? Is there another possible explanation?*, and *Why is this solution better than the alternatives?* can encourage

9. Challenges and Limitations

Although the literature generally supports the use of problem-solving approaches for developing critical thinking and decision-making, several challenges and limitations should be acknowledged.

First, critical thinking is a complex and multidimensional construct that has been defined differently across educational and psychological traditions. Different researchers may emphasize skills such as analysis and evaluation, while others place greater emphasis on dispositions, reasoning, judgment, or metacognitive regulation (Facione, 1990). This conceptual variation can make comparisons between studies difficult, particularly when researchers use different definitions and assessment instruments to measure critical thinking.

Second, the effectiveness of problem-based approaches depends heavily on instructional design and implementation. Problems that are too simple may provide limited opportunities for higher-order thinking, while problems that are excessively complex may overwhelm students and create unnecessary cognitive demands. Effective problems should therefore be sufficiently challenging to require analysis and evaluation while remaining appropriate for students' existing knowledge and abilities (Jonassen, 2000). The teacher's role is also important because students may require guidance, questioning, feedback, and scaffolding while learning to approach complex problems.

Third, students may need explicit instruction in critical-thinking and metacognitive strategies. Simply placing students in groups or providing them with open-ended problems does not guarantee that they will reason critically. Students may accept information without evaluating it, rely on unsupported assumptions, or select solutions without considering alternatives. Explicit instruction can help students understand how to question assumptions, evaluate evidence, compare alternatives, justify conclusions, and monitor their own reasoning (Schraw & Moshman, 1995). Therefore, problem-solving activities are likely to be more effective when teachers deliberately integrate opportunities

10. Conclusion

Developing critical thinking and decision-making abilities is an important goal of contemporary education. The literature reviewed in this article indicates that problem-solving strategies can provide a meaningful pathway for achieving this goal because they require students to engage in analysis, evaluation, reasoning, judgment, and reflection (Facione, 1990; Liu & Pásztor, 2022). Rather than treating critical thinking as a skill that can be developed independently from learning activities, educators can create learning environments in which students regularly apply critical-thinking processes to meaningful problems and decisions.

Problem-based learning, collaborative problem solving, inquiry-based learning, case-based learning, and metacognitive strategies are particularly promising approaches. Evidence suggests that appropriately designed problem-based learning can have positive effects on critical thinking, although outcomes vary according to instructional design and educational context (Liu & Pásztor, 2022; Anggraeni et al., 2023). Their effectiveness therefore depends on deliberate instructional design. Problems should be meaningful and sufficiently challenging, students should receive appropriate guidance and scaffolding, opportunities for collaboration and reflection should be incorporated, and assessment should focus on the quality of reasoning as well as the final outcome.

The development of critical thinking and decision-making should not be treated as an additional activity separated from subject-matter learning. Instead, these competencies can be embedded within the process of learning itself. When students are consistently asked to define problems, evaluate evidence, consider alternative solutions, justify decisions, and reflect on their reasoning, problem solving becomes more than a method for finding answers. It becomes a strategy for developing thoughtful, independent, and responsible learners who are better prepared to respond to complex academic, professional, and real-world situations.

The overall evidence therefore supports an integrated approach in which problem solving provides the context, critical thinking provides the reasoning, decision making guides action, and metacognition supports reflection and improvement. Such an approach can help educators move beyond the transmission of knowledge toward the development of learners who are capable of thinking carefully, making informed judgments, and taking responsibility for their decisions.

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