


Construct an instructional approach based on collaborative learning and reflective learning for enhance students' analytical thinking and critical thinking skills



 Rui Guo¹⁺

 Nirat Jantharajit²

 Phichittra
Thongpanit³

^{1,2,3} Faculty of Education, Nakhon Phanom University, Thailand.

¹ Email: 670811175@qq.com

² Email: n20jann@hotmail.com

³ Email: Phichittra@npu.ac.th



(+ Corresponding author)

ABSTRACT

Article History

Received: 15 July 2024

Revised: 28 August 2024

Accepted: 13 September 2024

Published: 1 October 2024

Keywords

Analytical thinking skill

Collaborative learning

Critical thinking

Instructional approach

Reflective learning.

In the context of rapid globalization and digitalization, the development of students' critical and analytical thinking skills is increasingly prioritized in education. This study aims to address the gap in instructional models by designing an eight-step instructional model that integrates collaborative and reflective learning strategies to enhance these essential skills. Drawing on social constructivist theories and Dewey's reflective thinking framework, the research develops a comprehensive model that includes phases such as goal setting, team formation, exploration, collaborative practice, reflection, integration, and feedback. The findings suggest that this model significantly improves students' analytical and critical thinking abilities by promoting structured collaboration and intentional reflection. Through diverse group interactions and continuous self-assessment, students achieve a deeper understanding and critical analysis. The model's iterative feedback mechanisms also contribute to sustained improvements in student learning outcomes. This study introduces an original instructional model that theoretically supports the enhancement of analytical and critical thinking skills through a systematic integration of collaborative and reflective learning, offering practical implications for educators seeking to foster these higher-order thinking skills in students.

Contribution/ Originality: This study's originality lies in the development of an eight-step instructional model that uniquely integrates collaborative and reflective learning strategies, offering a systematic approach to enhancing students' analytical and critical thinking skills. Unlike previous models, this approach emphasizes iterative feedback loops and diverse group interactions for sustained improvement.

1. INTRODUCTION

In an era of rapid globalization, digitalization, and the emphasis on developing critical and analytical thinking among students, education has prioritized these aspects. These higher-order thinking skills form the foundation of academic achievement and are essential for students' future careers and life experiences (Facione, 2011). Therefore, both educators and researchers conduct studies on teaching strategies to facilitate learning activities that require these critical abilities. Collaborative learning and reflective learning, widely recognized approaches to learning by researchers, are considered among the most effective methods.

Collaborative learning is an instructional method where students work together through cooperation and dialogue. Group inquiry also enhances students' ability to think critically as they gain diverse perspectives (Johnson, Johnson, & Smith, 2014). In addition to being an effective academic tool, group learning allows students

to view collaboration from a different perspective, forge new friendships, and demonstrate their teamwork skills (Gillies, 2016). Students engage in questioning, arguing, and discussions, providing opportunities to expand their knowledge and develop verbal skills and problem-solving abilities (Slavin, 2015).

Another mode of learning is reflective learning, which encourages self-reflection and evaluation during the learning process. Reflection leads to the identification and correction of learning strategies and thought processes, thereby enhancing students' metacognitive abilities (Moon, 2004). Reflective learning helps students not only understand the content, but also develop their analytical and problem-solving skills. Research has been successful in examining the effectiveness of reflective learning on students' critical thinking and self-management skills (Schön, 1983).

Considering the considerable influence of both collaborative learning and reflective learning on analytical and critical thinking skills, this study designed an instructional model that is used to integrate the two methods and thus enhance the students' analytical and critical thinking skills. The research will focus on answering the following question: How can collaborative learning and reflective learning strategies be effectively integrated in practical teaching?

2. LITERATURE REVIEW

2.1. Collaborative Learning

Collaborative learning is a teaching method in which students communicate with their peers and build knowledge (Habibah, Suratno, & Iqbal, 2023). It implies the collaboration, communication, and computer software that enable learners to work together (Patil, Bhadri, Shet, & Hombalimath, 2023). The idea stresses on the formation of a learning atmosphere where both the teacher and students work together, thus, helping the students to acquire knowledge through shared experiences (Parkavi, Karthikeyan, & Abdullah, 2022). Collaborative learning can be made easy by different means like, problem-solving, active learning methods, and computer-aided communication. It is a process that promotes the development of critical thinking skills, decision-making, strategic planning, and problem-solving activities among students which in turn, leads to the strengthening of the mastery of concepts and the acquisition of a scientific attitude.

Collaborative learning is an important part of education and professional development, which has a great influence on performance and knowledge construction (Qureshi, Khaskheli, Qureshi, Raza, & Yousufi, 2023). It is of great significance in the virtual higher education, where it facilitates the joint construction of knowledge and the development of the necessary skills (Herrera-Pavo, 2021). Nevertheless, it is important to combine collaborative and individual learning, as both are required for the real meaningful learning (Yadin & Or-Bach, 2010). The collaborative learning process is a process of the interaction between different perspectives and the building of shared knowledge which results in the construction of new understandings (Puntambekar, 2006). This process can be improved by the capture and structuring of information and the extraction of the relevant knowledge (Caballe, Daradoumis, Xhafa, & Conesa, 2010). Collaborative learning is also beneficial to the development of critical thinking because it promotes the discussion, debate, and the assessment of various conclusions (Mandušić & Blašković, 2015). With mobile work, collaborative learning can be helped by different activities like walking into collaborative learning and sharing without articulating (Lundin & Magnusson, 2003).

2.2. Reflective Learning

Reflective learning is the act of looking back at the past experiences in order to involve yourself in the learning process intentionally, which results in the mindful awareness and the capacity to make the conscious choices (Wang, Xu, Guo, Cai, & Liu, 2022). It is not only about just gaining knowledge but also the whole human maturation and transformation at the personal, social, and organizational levels (Colomer, Serra, Cañabate, & Bubnys, 2020). Reflective learning can be improved by different ways, like digital games in game-based learning

which are related to the reflective practices through the interactive and immersive experiences (Shaheen, Ali, & Fotaris, 2023).

The reflection learning is a significant element of the higher education, the professional development and the personal development (Boyd & Fales, 1983; Peltier, Hay, & Drago, 2005; Ryan & Ryan, 2013). It is a process, through which you go through the experiences, you understand their importance and you change your point of view (Boyd & Fales, 1983). This stage can be carried out by teachers through the demonstration and teaching of reflective practice (Hedberg, 2009). However, there are also the following issues with the good reflection, for example, the too much focus on the technical interests (Denton, 2011). On the contrary, the reflection can also be a source of a deeper learning and the testing of the pre-existing assumptions (Hedberg, 2009). The situation that the phenomenon plays a significant role in fields like mathematics, where it can lead to the cognitive advances, is especially important. Thus, the establishment of a reflection practice that is productive to both teachers and students is very significant (Loughran, 2002).

2.3. Analytical Thinking Skill

Analytical thinking is a very important skill which has wide-ranging consequences. It is a vital instrument that can be used in the evaluation and appraisal of strategic information systems planning (Pita, Cheong, & Corbitt, 2008) and on the other hand, it is related to the ambiguity of some concepts, the lack of traditional moral values, and the rise of creativity (Pennycook, Fugelsang, & Koehler, 2015). In mathematics, it is a must for the problem-solving process, and the high-ability students exhibit the pre-analytical and semi-analytical characteristics (Qolfathiriyus, Sujadi, & Indriati, 2019). In addition, analytical thinking is also related to the improvement of the mathematical skills and self-efficacy (Huincahue, Borromeo-Ferri, Reyes-Santander, & Garrido-Véliz, 2021). Teachers can acquire skills on how to transition from analogical to analytical thinking (Pesce, 2020) and researchers can use this information to create the new theoretical insights (Zyphur, 2009). Besides, it is also the main part of the critical thinking which consists of the reasoning, analyzing, and applying the logic (Abduquodirovich, 2023).

2.4. Critical Thinking Skill

Critical thinking is an important skill in the education system, because it enables students to analyze, evaluate and solve problems (Karakoc, 2016; Raj, Chauhan, Mehrotra, & Sharma, 2022). Apart from that, the directly active participation of the citizen and the realization of the society that is sustainable are also very important (Enciso, Enciso, & Daza, 2017). Currently, the 21st century, the skill of critical thinking is becoming more and more important due to the high rate of the information (Dwyer, Hogan, & Stewart, 2014). A pseudo-type of critical thinking has been invented to improve the teaching process (Živković, 2016). Nevertheless, the difficulties of the acquisition of critical thinking skills and the educators have to apply the methods to be able to increase their development (Burman, 2000). Critical thinking is also one of the most important components of the decision-making process that results in better decisions in the personal and professional life (Turan, Fidan, & Yıldırım, 2019).

3. RESEARCH DESIGN

The main aim of this study is to come up with an instructional model which combines the collaborative learning and reflective learning to improve the students' analytical thinking and critical thinking skills. The next section will describe the research design, that entails the theoretical framework of the instructional model, the ways of the construction.

3.1. Theoretical Framework

Collaborative learning is based on social constructivist theories, especially Vygotsky's one, who stressed on the significance of social interaction in the cognitive development (Vygotsky, 1978). Collaborative learning is a process in which students work in small groups and cooperate with each other to solve problems, to finish tasks or to create projects. This way students grasp the material in a better way through discussion, debate and the sharing of different opinions (Johnson et al., 2014).

Reflective learning is founded on Dewey's theory of reflective thinking, that is, careful, persistent, and active thinking about any belief or supposed form of knowledge (Dewey, 1933). Reflective learning makes students to think critically about their life experiences, analyze their learning procedures, and connect them to the future applications (Moon, 2013).

3.2. Construction Methods

This study delineates the core concepts and fundamental elements of collaborative learning and reflective learning by reviewing relevant literature.

The collaborative learning is a type of instructional method that involves the students working together in small groups to attain the common goals, solve problems, and finish the tasks. The presented theory is based on the social constructivist theories, especially the one of Vygotsky, who stressed the importance of social interaction in cognitive development (Vygotsky, 1978). In a cooperative learning environment, students deeply understand the topic through the discussion, debating and the exchange of different opinions (Johnson et al., 2014).

Reflective learning is an instructional method that consists of self-reflection and evaluation, thus, students are able to profoundly understand the learning content and apply their knowledge in the practice. This method is created on Dewey's idea of reflection that consists of the active, persistent, and careful thinking about any belief or supposed form of knowledge (Dewey, 1933). Reflective learning is a method that makes students to think deeply about their experiences, to analyze their learning processes and to make the connections to the future usage (Moon, 2013).

Table 1. Describes the essential elements of collaborative and reflective learning.

Reflective learning	Collaborative learning
<p>Intentional Reflection: Students consciously reflect on their learning experiences to identify key points and issues (Schön, 2017).</p> <p>Deep Thinking: Reflective learning requires students to not only memorize knowledge but also to understand its meaning, explain it, and apply it (Moon, 2004).</p> <p>Self-Assessment: Students evaluate their learning processes and outcomes, identifying strengths and weaknesses to adjust and improve (Boud, Keogh, & Walker, 1985).</p> <p>Feedback: Effective reflective learning involves feedback from teachers and peers to help students see aspects they might have missed and provide suggestions for improvement (Black & Wiliam, 1998).</p> <p>Practical application: Reflective learning extends beyond theoretical reflection to include the application of reflection results to solve real problems and guide future learning activities (Kolb, 1984).</p>	<p>Positive interdependence: Group members rely on one another to achieve the group's goals. Each member's contribution is essential for the group's success (Slavin, 1995).</p> <p>Face-to-face interaction: Students engage in direct interaction to share information and ideas, which promotes understanding (Gillies, 2016).</p> <p>Individual accountability: Each student is responsible for their own learning and for contributing to the group's success. This ensures that all members participate actively (Johnson & Johnson, 2009).</p> <p>Social skills: Collaborative learning requires students to develop communication, conflict resolution, and teamwork skills (O'Donnell & Hmelo-Silver, 2013).</p> <p>Group processing: Groups regularly reflect on their functioning and discuss ways to improve their collaboration to enhance efficiency and effectiveness (Johnson, Johnson, & Holubec, 2008).</p>

The fundamental elements of collaborative learning include: Positive Interdependence; Face-to-Face Interaction; Individual Accountability; Social Skills; Group Processing. The fundamental elements of reflective learning include: Intentional Reflection; Deep Thinking; Self-Assessment; Feedback; Practical Application. Table 1 outlines the core elements of collaborative and reflective learning.

Building upon these core concepts and fundamental elements, we have formulated an eight-step instructional model. The next chapter elaborates on this model.

4. RESEARCH RESULT

The instructional approach serves as a facilitator for both peer assessments and individual reflection. This learning process fosters an environment (refer to Figure 1) conducive to rapid acquisition of new knowledge by students. Teams consist of students from diverse backgrounds; as each member may bring unique abilities, complex problems become more understandable and easier to handle. Each time our students engage in co-creation, they participate in self-critical activities, continuously reflecting and refining their collaborative skills. An interactive fusion of concepts and materials ultimately guides students towards a collaborative consensus, enhancing the exceptional analytical and critical reasoning abilities of individuals in real-time. We will describe the eight-steps instructional model in more detail below.

4.1. Establish Goals and Themes

In the initial phase of this acquisition process, the teacher takes a central role, initiating the project setup. These goals outline the direction of the curriculum, aiding in maintaining focus and direction. This objective is achieved by providing detailed syllabi that outline the learning outcomes and necessary skills for course completion. The teacher has the opportunity to engage the class through insightful and lively presentations, dialogues, and modern teaching techniques. Learners are encouraged to articulate their individual learning designs, aligning them with the course objectives and their personal goals. Consequently, the teacher must ensure that all participants grasp the entirety of the planned activities and their specific purposes.

4.2. Team Formation

During this phase, it is the responsibility of the teacher to determine how students will be organized into heterogeneous teams. This distinction could be based on prerequisite courses, student interests, or a combination of both. Each member of our teams is intentionally selected from a diverse group, each with unique interests, talents, and perspectives. Essentially, diversity forms the foundation for creating a unified society that is open to listening, accepting, and engaging in dialogue on a wide range of topics, much like animals perceive, see, and comprehend their surroundings. The instructor may incorporate group activities and games to foster interaction, enabling students to appreciate, feel at ease, and learn about teamwork and personal competency. Essentially, the focus is on forming groups where each member contributes to achieving project goals, leveraging their unique talents and striving for greater professionalism in task completion.

4.3. Exploration Phase

During the initial time slot, students actively engage in research to explore the assigned theme. Information gathering from various sources is a crucial operation for every group, including academic papers, books, online databases, and expert interviews. Students are encouraged to share their initial information and understanding of the topic, fostering a collaborative learning environment. Throughout active participation, students are expected to read, discuss, and engage in interactive activities. With guidance from the tutor, students master appropriate research methods and critical analysis, facilitating a deeper understanding of the subject matter. This exploratory phase is crucial for setting the direction for subsequent group assignments.

4.4. Collaborative Practice

Participants who are conscientious take turns performing various calculations or tasks related to the lesson topic. Effective teamwork, communication, and problem-solving skills are crucial for this aspect, which prominently emphasizes them.

Students learn to patiently listen to each other, freely express their ideas without fear, and, equally importantly, employ collaborative problem-solving methods as a group. As group members, they come together, assigning tasks based on individual strengths and weaknesses, and collaborate to achieve the set goal. The teacher plays a supervisory role in the development of the groups, providing feedback and intervening as needed. Consequently, students are firstly provided with the opportunity to better understand the topic, and secondly, they improve their study skills.

4.5. Reflection and Discussion

After completing their assigned tasks, group members convene to reflect on their teamwork. They address questions such as what aspects worked well and how they approached various challenges. This reflective process, coupled with a deep internalization of the learning experience, enables students to identify areas for improvement in their future endeavors. The class engages in a guided discussion, providing groups with a platform to share experiences, reflections, and final outcomes. This mutual exchange facilitates opportunities for students to learn from each other and discover multiple perspectives within a single theme. Educators guide the discussions, identifying key learning points and encouraging students to conduct thorough investigations.

4.6. Integration and Presentation

Teams finalize their collaborative research and group work by creating a comprehensive package or presentation. Various options are available for the final project, including a written report, a multimedia presentation, a project demonstration, or a creative performance. Students engage their creativity and contemplate the most effective methods for presenting their projects. Each student group presents their portfolios to the class, receiving peer support and evaluation. The instructor and peers provide extensive feedback, enabling students to enhance their presentation skills and the quality of their assignments. This stage is a celebration of students' achievements and a showcase of their creativity and factual knowledge.

4.7. Summary and Evaluation

Together, the teacher and students collaborate to paint the big picture and summarize all learning processes. They assess whether the initial objectives have been achieved and evaluate the progress made toward attaining these objectives. This emphasizes the importance of assessing both learning targets and the effectiveness of the teaching model. Students are tasked with reflecting on their individual learning journeys to identify key takeaways and areas for further development. Educators provide a comprehensive evaluation, highlighting strengths and suggesting areas for improvement. This concluding evaluation stage of the teamwork ensures that students understand their current performance and the impact of their collaborations.

4.8. Reflection and Feedback

In the final stage, emphasis is placed on self-reflection and personalized forms of critique. A competent teacher guides students through the reflection process, focusing on evaluating learning outcomes and fostering personal growth. This concept is dual-folded, addressing both individual and collective aspects, allowing students to reflect on themselves as learners and team members, as well as their impact on the environment. The teacher provides detailed feedback to recognize the achievements of each student/group and offers guidance on areas for

improvement. This feedback inspires students to be open-minded, embrace challenges, and continue lifelong learning. This process instills an unparalleled sense of preparedness for facing future challenges.

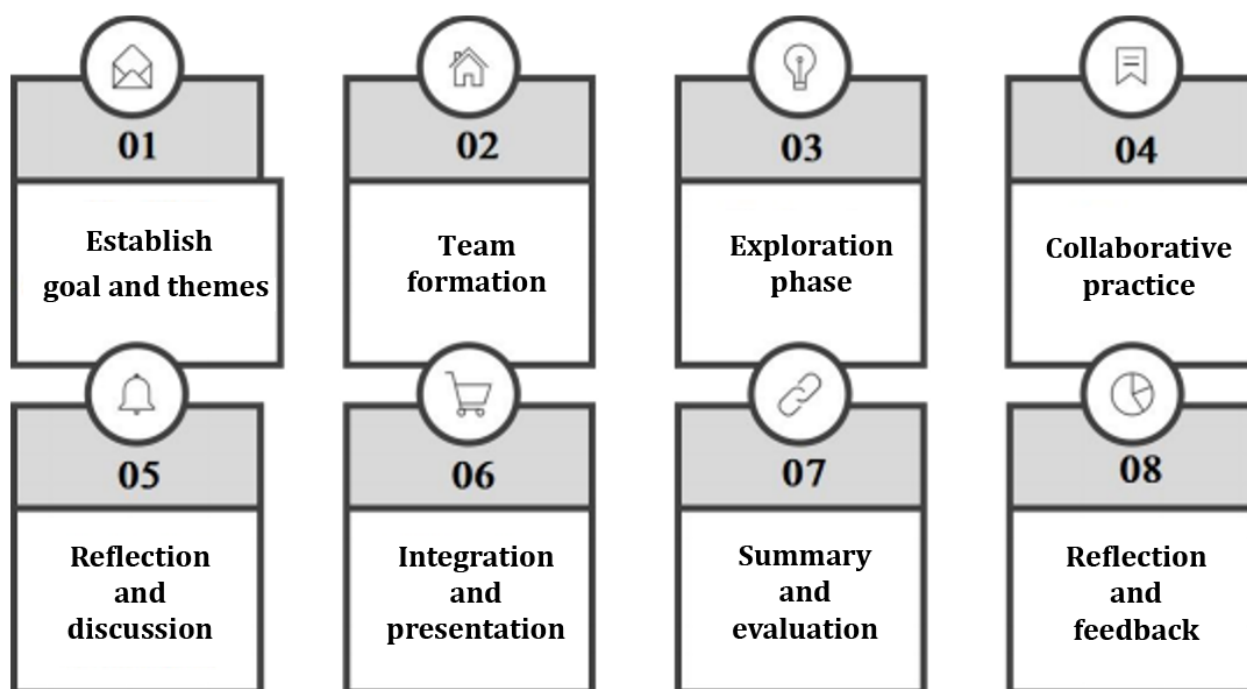


Figure 1. Illustrates instructional approach based on collaborative learning and reflective learning.

5. CONCLUSION & DISCUSSION

Adoption of collaborative learning in place as well as reflective learning in practice can increase student engagement, challenging the level of understanding while creating the key skills required by the learning process. The combination can be done through a certain sequence of steps, with students being able to interact and reflect during the learning period while maximizing the outcome for all throughout.

It is important that initially for teaching we establish the goal posts and what is the expected level of achievement. Teachers should set learning objectives and outcomes of the course and run through the skills and knowledge students should be able to grasp well before the end of the course. These goals not only give learners an understanding of the overall objectives of their collaborative tasks but as well as personalize each student's learning as the goals are set based on one's learning process. Through the provision of specific reflections ideas, teachers are able to help the pupils to focus on the learning goals as a whole because of the reflection process being more effective. The team creation process starts by the teacher putting students in groups that might be the requirement of the course or to the interests of the students based on their different backgrounds as well as skills. The diversity can bring a number of viewpoints which could innovate the way we solve problems. Through team-building exercises, trust and effective communication become established and in this environment each team member is able to complement their strengths and learn from others. Hence, they can not only gain from the available knowledge of every class member but also work successfully as a team member.

During the exploration and interactive learning stage, students begin to explore the topic, gather relevant information, and share existing knowledge. Teachers should encourage students to actively explore the topic through reading, discussion, and interactive activities, and provide various resources and support to help them deepen their understanding of the topic. The key to this stage is to stimulate students' curiosity and initiative, enabling them to develop critical thinking and research skills during the exploration process. At the same time, teachers can guide students to continuously reflect on their learning process and evolving understanding through

regular reflection checkpoints. Collaboration among group members is a crucial aspect of the learning process, ensuring that each member's contribution is indispensable by designing tasks that require mutual dependence among members. This not only enhances the effectiveness of collaboration but also cultivates students' teamwork and problem-solving abilities. Using collaborative tools such as shared documents, discussion forums, and project management software can facilitate communication and collaboration among group members, improving task efficiency. After each collaboration session, reflective discussions allow students to share their experiences, challenges, and insights, thereby learning and improving from each other's experiences.

Finally, in the stage of integrating and presenting learning outcomes, students consolidate their research findings and collaborative achievements to create a comprehensive work or presentation. This can be in the form of written reports, multimedia presentations, project demonstrations, or creative performances. By showcasing their learning outcomes, students can not only receive constructive feedback from teachers and peers but also further enhance their presentation skills and confidence. Throughout the learning process, teachers should provide real-time feedback, guiding students to stay on track and focused, and encouraging them to iteratively improve their work based on feedback received. This iterative process not only improves the quality of outcomes but also deepens students' understanding of the topic. At the end of the course, through comprehensive assessment, teachers and students jointly summarize the entire learning process, review the achievement of established objectives, and evaluate the effectiveness of learning outcomes and teaching methods. This stage also includes reflection on students' personal learning journeys, helping them identify key takeaways and areas for further development. By guiding students in deep reflection and providing personalized feedback, teachers can encourage students to maintain a growth mindset and stimulate their motivation for continuous learning and improvement.

By effectively integrating collaborative learning and reflective learning strategies in actual teaching, teachers can create a dynamic and engaging learning environment that enhances not only students' knowledge and skills but also cultivates their critical thinking, self-awareness, and lifelong learning habits. This teaching model not only promotes students' academic progress but also lays a solid foundation for their future personal and professional development.

During the literature review, we confirmed from previous scholars' studies that collaborative learning and reflective learning have positive effects on academic analytical and critical thinking skills. In this study, we constructed a teaching model based on the core concepts and basic elements of collaborative learning and reflective learning, and provided detailed explanations for each component of the model. However, this only considered its rationality theoretically. Therefore, this study also prepared us for subsequent research. In future studies, we will validate and refine this teaching model in practical teaching, and examine its effects on students' analytical and critical thinking skills from a statistical perspective.

Funding: This study received no specific financial support.

Institutional Review Board Statement: Not applicable.

Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

REFERENCES

Abduqodirovich, M. A. (2023). *Picularities and importance of critical thinking*. Paper presented at the International Scientific and Current Research Conferences. <https://doi.org/10.37547/geo-67>.

- Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, 80, 139-148.
- Boud, D., Keogh, R., & Walker, D. (1985). *Reflection: Turning experience into learning*. London, UK: Routledge.
- Boyd, E. M., & Fales, A. W. (1983). Reflective learning: Key to learning from experience. *Journal of Humanistic Psychology*, 23(2), 99-117. <https://doi.org/10.1177/0022167883232011>
- Burman, S. (2000). Critical thinking: Its application to substance abuse education and practice. *Journal of Teaching in Social Work*, 20(3-4), 155-172. https://doi.org/10.1300/j067v20n03_11
- Caballe, S., Daradoumis, T., Xhafa, F., & Conesa, J. (2010). Enhancing knowledge management in online collaborative learning. *International Journal of Software Engineering and Knowledge Engineering*, 20(04), 485-497. <https://doi.org/10.1142/s0218194010004839>
- Colomer, J., Serra, T., Cañabate, D., & Bubnys, R. (2020). Reflective learning in higher education: Active methodologies for transformative practices. *Sustainability*, 12(9), 3827. <https://doi.org/10.3390/su12093827>
- Denton, D. (2011). Reflection and learning: Characteristics, obstacles, and implications. *Educational Philosophy and Theory*, 43(8), 838-852. <https://doi.org/10.1111/j.1469-5812.2009.00600.x>
- Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Boston, MA: D.C. Heath and Company.
- Dwyer, C. P., Hogan, M. J., & Stewart, I. (2014). An integrated critical thinking framework for the 21st century. *Thinking skills and Creativity*, 12, 43-52. <https://doi.org/10.1016/j.tsc.2013.12.004>
- Enciso, O. L. U., Enciso, D. S. U., & Daza, M. d. P. V. (2017). Critical thinking and its importance in education: Some reflections. *Rastros Rostros*, 19(34), 78-88.
- Facione, P. A. (2011). Critical thinking: What it is and why it counts. *Insight Assessment*, 1(1), 1-23.
- Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39-54.
- Habibah, L., Suratno, & Iqbal, M. (2023). The effect of collaborative learning model combined with problem solving on critical thinking ability and mastery of biology concept of high school students in coffee plantation area. *International Journal of Research and Review*, 10(2), 588. <https://doi.org/10.52403/ijrr.20230270>
- Hedberg, R. P. (2009). Learning through reflective classroom practice: Applications to educate the reflective manager. *Journal of Management Education*, 33(1), 10-36. <https://doi.org/10.1177/1052562908316714>
- Herrera-Pavo, M. Á. (2021). Collaborative learning for virtual higher education. *Learning, Culture and Social Interaction*, 28, 100437.
- Huincahue, J., Borrromeo-Ferri, R., Reyes-Santander, P., & Garrido-Véliz, V. (2021). Mathematical thinking styles—the advantage of analytic thinkers when learning mathematics. *Education Sciences*, 11(6), 289. <https://doi.org/10.3390/educsci11060289>
- Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365-379. <https://doi.org/10.3102/0013189x09339057>
- Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2008). *Cooperation in the classroom*. Edina, MN: Interaction Book Company.
- Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving university instruction by basing practice on validated theory. *Journal on Excellence in University Teaching*, 25(4), 1-26.
- Karakoc, M. (2016). The significance of critical thinking ability in terms of education. *International Journal of Humanities and Social Science*, 6(7), 81-84.
- Kolb, B. (1984). Functions of the frontal cortex of the rat: A comparative review. *Brain Research Reviews*, 8(1), 65-98.
- Loughran, J. J. (2002). Effective reflective practice: In search of meaning in learning about teaching. *Journal of Teacher Education*, 53(1), 33-43. <https://doi.org/10.1177/0022487102053001004>
- Lundin, J., & Magnusson, M. (2003). Collaborative learning in mobile work. *Journal of Computer Assisted Learning*, 19(3), 273-283. <https://doi.org/10.1046/j.0266-4909.2003.00029.x>

- Mandušić, D., & Blašković, L. (2015). The impact of collaborative learning to critically thinking. *Trakia Journal of Sciences*, 13(1), 426-428. <https://doi.org/10.15547/tjs.2015.s.01.073>
- Moon, J. (2004). *A handbook of reflective and experiential learning*. London: Routledge Falmer.
- Moon, J. A. (2013). *A handbook of reflective and experiential learning: Theory and practice*. London, UK: Routledge.
- O'Donnell, A. M., & Hmelo-Silver, C. E. (2013). Introduction: What is collaborative learning?: An overview. In the International Handbook of Collaborative Learning. In (pp. 1-15): Taylor and Francis. <https://doi.org/10.4324/9780203837290-6>.
- Parkavi, R., Karthikeyan, P., & Abdullah, A. S. (2022). *Collaborative learning: A case study on information security and auditing management course*. Paper presented at the 2022 International Conference for Advancement in Technology (ICONAT). IEEE. <https://doi.org/10.1109/ICONAT53423.2022.9726091>.
- Patil, L. R., Bhadri, G. N., Shet, A. R., & Hombalimath, V. S. (2023). Active and collaborative learning approach in unit operations laboratory by open-ended experiments using the concept of design of experiments (DOE). *Journal of Engineering Education Transformations*, 36(Special Issue 2), 581-589. <https://doi.org/10.16920/jeet/2023/v36is2/23089>
- Peltier, J. W., Hay, A., & Drago, W. (2005). The reflective learning continuum: Reflecting on reflection. *Journal of Marketing Education*, 27(3), 250-263. <https://doi.org/10.1177/0273475305279657>
- Pennycook, G., Fugelsang, J. A., & Koehler, D. J. (2015). Everyday consequences of analytic thinking. *Current Directions in Psychological Science*, 24(6), 425-432. <https://doi.org/10.1177/0963721415604610>
- Pesce, S. (2020). From analogical to analytical thinking and back: The adaptation of teachers' reasoning to complex situations. In adapting human thinking and moral reasoning in contemporary society. In (pp. 223-244). Hershey, PA, USA: IGI Global.
- Pita, Z., Cheong, F., & Corbitt, B. (2008). *Analytic thinking approach: An application in assessment and measurement of strategic information systems planning*. Paper presented at the ACIS 2008 Proceedings, 18.
- Puntambekar, S. (2006). Analyzing collaborative interactions: Divergence, shared understanding and construction of knowledge. *Computers & Education*, 47(3), 332-351. <https://doi.org/10.1016/j.compedu.2004.10.012>
- Qolfathiriyus, A., Sujadi, I., & Indriati, D. (2019). *Characteristic profile of analytical thinking in mathematics problem solving*. Paper presented at the Journal of Physics: Conference Series.
- Qureshi, M. A., Khaskheli, A., Qureshi, J. A., Raza, S. A., & Yousufi, S. Q. (2023). Factors affecting students' learning performance through collaborative learning and engagement. *Interactive Learning Environments*, 31(4), 2371-2391. <https://doi.org/10.1080/10494820.2021.1884886>
- Raj, T., Chauhan, P., Mehrotra, R., & Sharma, M. (2022). Importance of critical thinking in the education. *World Journal of English Language*, 12(3), 126-133.
- Ryan, M., & Ryan, M. (2013). Theorising a model for teaching and assessing reflective learning in higher education. *Higher Education Research & Development*, 32(2), 244-257. <https://doi.org/10.1080/07294360.2012.661704>
- Schön, D. A. (2017). *The reflective practitioner: How professionals think in action*. London, UK: Routledge.
- Schön, J. (1983). *Petrophysics: Physical properties of rocks and minerals*. Berlin, Boston: De Gruyter. <https://doi.org/10.1515/9783112707715>.
- Shaheen, A., Ali, S., & Fotaris, P. (2023). Assessing the efficacy of reflective game design: A design-based study in digital game-based learning. *Education Sciences*, 13(12), 1204. <https://doi.org/10.3390/educsci13121204>
- Slavin, R. E. (1995). *Cooperative learning theory research and practise* (Vol. 419). Boston: Allyn and Bacon Publishers.
- Slavin, R. E. (2015). Cooperative learning in elementary schools. *Education 3-13*, 43(1), 5-14. <https://doi.org/10.1080/03004279.2015.963370>
- Turan, U., Fidan, Y., & Yıldıran, C. (2019). Critical thinking as a qualified decision making tool. *Journal of History Culture and Art Research*, 8(4), 1-18. <https://doi.org/10.7596/taksad.v8i4.2316>
- Vygotsky, L. (1978). Mind in society: The development of higher psychological processes. In (pp. 87). Cambridge: Harvard University Press.

- Wang, L., Xu, X., Guo, K., Cai, B., & Liu, F. (2022). Reflective learning with label noise. *IEEE Transactions on Circuits and Systems for Video Technology*, 33(7), 3343-3357. <https://doi.org/10.1109/tcsvt.2022.3231887>
- Yadin, A., & Or-Bach, R. (2010). The importance of emphasizing individual learning in the “collaborative learning era”. *Journal of Information Systems Education*, 21(2), 185-194.
- Živković, S. (2016). A model of critical thinking as an important attribute for success in the 21st century. *Procedia-Social and Behavioral Sciences*, 232, 102-108. <https://doi.org/10.1016/j.sbspro.2016.10.034>
- Zyphur, M. J. (2009). When mindsets collide: Switching analytical mindsets to advance organization science. *Academy of Management Review*, 34(4), 677-688. <https://doi.org/10.5465/amr.34.4.zok677>

Views and opinions expressed in this article are the views and opinions of the author(s). Asian Journal of Contemporary Education shall not be responsible or answerable for any loss, damage or liability etc. caused in relation to/arising out of the use of the content.