# The Role of Collaborative Learning in the Online Education

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**Abstract**
Collaboration or teamwork is indispensable in today's workplace. The continual and increasingly rapid change in the external environment requires professionals equipped with unique skill sets to work together and solve problems collaboratively. It is the higher education institution's responsibility to prepare students for the necessary skills expected by the employers. Collaborative learning is an active learning approach that two or more students team up toward common goals. The knowledge and product are created through the active, social, and engaging process. Students develop communication, interpersonal, metacognitive thinking, and problem-solving skills, as well as their understanding of the diverse perspectives for real-world profession-related situations. Furthermore, working in a team could reduce student's feelings of isolation in the online learning environment. As such more and more online programs incorporate collaborative learning into their curricula. In this paper, the benefits, challenges, and solutions to challenges in collaborative learning are presented and discussed.

**Keywords:** collaborative learning, metacognition, online education, problem solving, teaching presence

## 1. Introduction

With the advanced development in communication technology, online or web-based courses have been offered to adult learners who might not otherwise attend physical campus classes due to job commitment, family demands, and other life obligations. This learning modality has broadened the opportunities for students to learn everywhere (Sumadyo et al., 2021). Especially the COVID-19 pandemic has affected people's lives globally since early 2020. It has changed the landscape of education and prompted traditional higher education institutions to adopt online learning as quickly as possible. However, not all students could do well in the online education because the feeling of isolation and loneliness negatively impacts the online learning experience. It depends on students' ability to manage their time for learning via the process of metacognition (Lyons et al., 2021; Busch et al., 2021). In response to such an issue, more and more higher education institutions incorporate collaborative learning in the online classrooms, where students learn together and develop their social competencies, critical thinking, and self-reflection skills (Busch et al., 2021).

This article will focus on a survey of collaborative learning. It starts with an introduction, followed by four main sections. The first section details the definitions of collaborative learning from various scholars. Benefits of collaborative learning will be presented in the next section. The following section will examine challenges found in collaborative learning that are described in literature. The solutions to overcome challenges emphasizing teaching presence will be depicted in the last section.

## 2. What is Collaborative Learning?

Strijbos (2016) defined collaborative learning as a learning occurrence where learners in a group interact on the similar or dissimilar attributes of a shared task to acheive implied or definite shared learning goals. Collaborative learning is a teaching and learning strategy that involves two or more students in a group who have different abilities and thoughts and are jointly engaged in a learning process (Dewi et al., 2021; Hadwin et al., 2018; Warsah et al., 2021). Collaborative Learning is known as an approach to group learning and can be an appropriate and effective method to train students for the 21$^{st}$-century skills to solve a problem, complete a task, or create a product in the learning process (Azar et al., 2021).

Collaborative learning is based on the notion that learning is an obviously social interaction in which the participants converse among themselves to search for better understanding, meanings, and/or solutions, or create a realistic product as the solution (Azar et al., 2021). In collaborative learning, participants have their responsible roles and are more comfortable generating ideas, share their knowledge, and solve problems together with their group members (Koretsky et al., 2021; Warsah et al., 2021). They do not feel isolated because they support each other in the learning process and rely on each other to attain new knowledge (Dewi et al., 2021; Warsah et al., 2021). When they do the tasks in groups, collaborative learning helps them develop a deeper understanding of course materials and retain more information (McHugh et al., 2020). Therefore, learning in a group becomes more interesting and meaningful (Azar et al., 2021). For those participants who are behind in their studies, they could perform better eventually because of collaborative learning (Warsah et al., 2021).

Although cooperative learning is a type of collaborative learning, there are some distinct differences between both (Azar et al., 2021; Linder & Hayes, 2018). In cooperative learning, students in a small group work together on a structured activity; tasks are divided independently, and each is accountable for his/her individual work (Wang & Wang, 2021). Learning is done by individuals in cooperative learning that focuses on each portion of the tasks delegated to everyone in a group (Linder & Hayes, 2018; Wang & Wang, 2021). Finally, a collection of individual work is assessed as their group product (Linder & Hayes, 2018). The student grouping pattern for cooperative learning takes less consideration of the complementarity of students' knowledge and learning interests (Wang & Wang, 2021). In contrast, collaborative learning requires argumentation, negotiation, mutual engagement, and the indispensable nature of individual contributions to the group project tasks (Han & Ellis, 2021; Linder & Hayes, 2018). Unlike delegated group work in cooperative learning, collaborative learning actively encourages group interactions like sharing ideas and knowledge, and the group members are mutually dependent on constructing and maintaining a shared task (Linder & Hayes, 2018). Cooperative learning can be beneficial; conversely, collaborative learning provides even greater educational

benefits to enhance students' knowledge and skills (Linder & Hayes, 2018). For example, students' social skills are improved since mutual helping and sharing are highly expected in collaborative learning (Azar et al., 2021).

## 3. Benefits of Collaborative Learning

In comparison to individual learning, Lyon et al. (2021) asserted that collaborative learning advances students' conceptual understanding, creative problem solving, participation, skill development, and socialization. Collaborative learning, as Warsah et al. (2021) contented, has a convinced influence on the learners' cognitive learning processes as well as social and emotional functions. In collaborative learning, students interact with their peers, collaborate to solve obstacles during learning, exercise their reasoning and metacognitive skills, and develop their responsiblity for the learning (Warsah et al., 2021). Collaborative learning strengthens learners by inspiring them to learn, bettering their awareness to learning, fostering their positive mindsets towards learning, and supporting them to learn uninterruptedly; subsequently, their learning results are advanced, and their academic achievements are improved (Han & Ellis, 2021; Lyon et al., 2021; Warsah et al., 2021). Han and Ellis (2021) considered collaborative learning as helpful to develop additional critical studying skills, such as critical thinking, decision-making, higher-order metacognitive, and problem-solving, which lead to positive attitudes and motivation in learning, enhanced student engagement and deeper learning, and, ultimately, better academic performance.

Collaborative learning has a positive influence on improving learners' critical thinking skills (Han & Ellis, 2021; Kurniasih, et al., 2016). Critical thinking is deemed as an ability to question, evaluate, interpret, reflect, reason, and make informed judgments and decisions (Warsah et al., 2021). Howard et al. (2015) described critical thinking skills as the thinking process by using one's knowledge, judgments, and reflective experiences. Under such thinking processes, one is capable of justifying a problem, recognizing the interrelationships between the problem and its related elements, analyzing and validating facts in relation to the problem, and drawing a compelling conclusion, so that the problem can be solved, and proper deductions of what to do in the future can be made (Howard et al., 2015; Warsah et al., 2021).

Self-regulated learning denotes one's ability to understand and control one's goal setting, self-instruction, self-monitoring, and self-reinforcement, which is an important skill in the online learning environment (De Backer et al., 2022). Self-regulation is associated with metacognition (De Backer et al., 2022; Garrison, 2022). Metacognition refers to growing awareness of the learning process and taking responsibility of implementing strategies to manage the learning process (Garrison, 2022). Metacognition is crucial to any form of learning (Dindar et. al., 2020). Prior study on self-regulated learning revealed that tactically utilizing metacognitive regulation promotes students' learning outcomes during individual learning (Zimmerman, 2002). Self-regulated learners with metacognitive skills are proactive in the learning processes; they are aware of their knowledge and competencies for organizing, guiding, and controlling their own thinking and actions (Sumadyo et al., 2021). Garrison (2022) described shared metacognition as an understanding of one's learning in the processes of creating meaning and building comprehensions related self with others. In collaborative learning, it is necessary to initate regulation strategies by various team members who jointly take part in controlling and regulating

the team's learning at the behavioral, cognitive, contextual, and motivational level (De Backer et alm, 2022; Zhao & Ye, 2020), which is referred to as socially shared regulation (Hadwin et al., 2017).

Collaborative learning establishs the circumstances for thinking and learning collaboratively. The essence of collaborative learning is the students' connectedness that stimulates comprehension and innovative thinking through critical discourse (Busch et al., 2021; Warsah et al., 2021). Students take responsibility and manage the collaborative inquiry that demands awareness and responsibility for observing and managing a complex shared learning dynamic (McHugh et al., 2020). Students in collaborative learning have the advantage to think critically and creatively (Dindar et. al., 2020). Hence, innovation and problem-solving have the most significant opportunity to emerge from metacognitive thinking processes (Timonen & Ruokamo, 2021).

During the learning process, students engage in cognitive interactions and socioemotional interactions, which, in turn, shape one another and the group's overall performance (McHugh et al., 2020; Isohätälä et al., 2019). Cognitive interactions refer to the circumstance that learners are actively involved in the processes of analyzing, elaborating, thinking, and reasoning to deepen their understanding of the learned material (Isohätälä et al., 2019). Socioemotional interactions act as a source of motivations for students in the group and help them relate to each other, be compassionate, and feel the spirit of their collaborations with each other (Isohätälä et al., 2019; Järvenoja et al, 2020).

Collaborative learning also fosters peer interactions. An active interaction among learners improves the process of knowledge creation for an individual learner. Active learning occurs when students actively participate in knowledge construction instead of passively receiving knowledge taught by the instructor. Active interactions can be achieved by inquiring, discussing, explaining to each other, debating, and actively engaging in knowledge construction processes *(*Sumadyo et al., 2021). Consequently, collaborative learning builds valuable interpersonal and communication skills that help students transition into or advance their professional careers.

## 4. Challenges in Collaborative Learning

Individuals assigned to a group or team do not automatically produce collaborative learning. The challenges associated with collaborative learning can be classified into three main themes (Han & Ellis, 2021). The first challenge is the setting of collaboration, such as group composition and group size (Han & Ellis, 2021; Sidorenkov et al., 2018). The second challenge refers to learning activities in collaboration, including types of activities, structure of activities, and the availability of scaffolding (Han & Ellis, 2021; Tan et al., 2016). The third challenge includes student factors, for instance, affect and emotion, attitudes, self-efficacy, self-regulation, and metacognition (Han & Ellis, 2021).

### *4.1 Setting of Collaboration*

Similar to the multidisciplinary or interdisciplinary teams formed in the workplace, the teams in the online classrooms are composed of various professionals who have developed their own social identities as individuals are socialized into their professional communities of practice. The

combination of various professionals with diverse backgrounds and perspectives frequently triggers intragroup conflict, which may negatively affect the quality of teamwork (Walston & Johnson, 2022). The literature has reported that the most prevalent conflict types comprise conflicts of processes, relationships, and tasks (Behfar et al., 2011). On the other hand, diverse teams tend to avoid groupthink by objectively interrogating other members' actions. Diverse in age, personality, and gender could be very synergistic or harmful to the teamwork (Sidorenkov et al., 2018; Walston & Johnson, 2022). To reduce conflict and maintain unity in a group, as Sidorenkov et al. (2018) suggested, the optimal group size should be four to six.

### 4.2 Learning Activities in Collaboration

The type of activities, structure of activities, and the availability of scaffolding could determine the success of collaborative learning. The collaborative learning model shifts from a teacher-centered approach to a learner-centered one (Han & Ellis, 2021). It is built on the basis that knowledge is generated via social interaction and construction so that students can read, respond, and participate by expressing and discussing their ideas and opinions to solve real-world problems (Dewi et al., 2021; Hadwin et al., 2018). Scaffolding, a teaching strategy, can provoke the metacognitive processes if used properly (Hadwin et al., 2018; Lyon et al., 2021). The learning activities used in collaborative learning, as suggested by Tan et al. (2016), should be complex and exemplary for a professional context to ensure that the students' learning and the developed knowledge are pertinent to their profession. Suppose the learning activities in collaborative learning are not connected to the specific, authentic, and relevant real-world issues. In that case, students might lose interest in interacting with their peers in the metacognitive process (Lyon et al., 2021). Moreover, the complexity of the problem should be appropriate for a team to solve; If the learning activities are too easy or too difficult, they will not result in collaboration (McHugh et al., 2020; Lyon et al., 2021).

### 4.3 Student Factors

Students participating in collaborative learning may encounter cognitive, emotional, and motivational obstacles within their teams (Koretsky et al., 2021; Lyon et al., 2021). For example, cognitive conflicts can stem from how different members in the team grasp the tasks and team project, what they understand about the content and the requirements for the team project, or what they believe is the best strategy to complete all tasks (Butt, 2017; Lyon et al., 2021). Emotional and motivational conflicts can result from differences in team members in terms of personalities and unequal participation from team members who behave as free riders or social loafers (Busch et al., 2021; Lyon et al., 2021).

Under the notion of collaborative learning, besides degrees of commitment, students should demonstrate various levels of skills in communication, collaboration, organization, and time management (Brannen et al., 2021). In consequence, ineffective communication, inequitable contribution of efforts, diverse perceptions of quality work among team members, and unwilling to accommodate multiple individuals' schedules contribute to the failure of collaborative learning (Butt, 2017). Furthermore, some students do not like team assignments because they feel that teamwork is a source of stress and frustration (Busch et al., 2021; Butt, 2017; Kima & Lim, 2018). The increased interdependence among team members to engender ideas and

undertake a task has a greater potential for conflict (Busch et al., 2021). Students voice their anxiety and conflict because they are working with their teammates who have different attitudes and objectives or are less engaged in the collaborative learning (Kima & Lim, 2018). Consequently, their grades might be impacted, resulting in anxiety surrounding the desired grades and disputes between students (Busch et al., 2021; Butt, 2017).

In the online learning environment, additional challenges could be added to collaborate learning. Students are working professionals who might reside in different time zones and have different working schedules, which brings about increased difficulty in collaboration, communication, and setting deadlines (Brannen et al., 2021). Accordingly, some students dislike to work as a team since they might face certain issues such as a family emergency that occurred in a team member that could hinder their progress and, eventually, change their grades (Azar et al., 2021). Additionally, online learning requires much more self-discipline, which is a skill that not every individual naturally possesses, but it is an essential skill required for collaboration (Brannen et al., 2021).

## 5. Solutions

Several identified approaches can increase the effectiveness of collaborative learning (Koretsky et al., 2021). These include the context and quality of the learning activities and the team members' engagement in the interpersonal coordination of their cognitive processes (Koretsky et al., 2021). In reference to learning tasks and contexts, many scholars have confirmed that authentic, complex, challenging, and relevant learning activities keep students engaged in the entire learning process (McHugh et al., 2020; Wen, 2022). Theoretically and empirically, each team member is responsible for participating in collaborative learning. In realty, there are numerous barriers hindering students' engagement in collaborative learning. For that reason, the instructor needs to take on several roles, for instance facilitator, guide, and helper, to ensure the collaborative learning process goes as intended.

The instructor's presence is the essence of collaborative learning (Garrison, 2022). The instructor should facilitate the learning processes in which students are encouraged to self-regulate and take responsibility of their learning (Brannen et al., 2021). While the instructor initiates the process of inquiry, students are often motivated to metacognitively think about how they should manage their learning processes (Brannen et al., 2021). As soon as students realize the dynamic of purposeful inquiry, they will be more aware of their roles in collaborative learning—completing their tasks and managing their learning progress to achieve projected learning outcomes efficiently and effectively (Brannen et al., 2021; McHugh et al., 2020; Janssona et al., 2021). Consequently, students will be able to support both their own and other students' inquiry processes (Janssona et al., 2021).

An instructor also serves as a guide or moderator for the students and helps them during the collaborative learning activity. If the work is not appropriate, the instructor is responsible for changing the work based on the objectives of the task (Azar et al., 2021). Instructors also need to have a positive and enthusiastic attitude towards applying collaborative learning methods in the classroom. When the instructor nurtures a trustworthy and welcoming collaborative learning environment, team members tend to trust and value other teammates' ideas and contributions

(Zhao & Ye, 2020). As a result, collaboration will be engendered based on genuine interdependence, a shared consensus of purpose, and a division of labor (Azar et al., 2021; Zhao & Ye, 2020).

Furthermore, during the process of collabartive learning individual students may need additional advice and support, and the instructor can be a help provider to speed up the learning process. The instructor should quickly reply to students' questions and offer timely assistance, feedback, and guidance to reduce students' frustration and stress (Busch et al. 2021; Makani et al., 2016). The instructor could build checkpoints to monitor the team's development and ensure that team members are working collectively to accomplish the project in collaborative learning process (Milman, 2015). Finally, the instructor also plays a vital role in resolving relationship conflicts when team members are not able to resolve the conflicts within the team (Brannen et al., 2021). Overall, the instructor should intervene more to help build a positive and effective collaborative learning experience in the classroom by minimizing confusion and misunderstanding among students and promoting the impartial distribution of work and responsibility.

## 6. Conclusion

There has been a concern that the traditional teacher-centered approach is ineffectively taught. Students often miss key information instructed by the teacher since they do not share the process of discourse and discovery with their peers. Collaborative learning is student-centered learning and has existed in higher education for decades. In collaborative learning process, students work together to solve a real-world issue or create a team product, which gives rise to countless benefits such as better communication, critical thinking, interpersonal, problem-solving, self-directed learning, and leadership skills. Collaborative learning is essential to online learning since working in a team could ease the feeling of isolation and keep students engaged in the learning process. Ultimately, higher student satisfaction, student retention, and academic performance are expected. Effective collaborative learning does not come naturally, and challenges in collaborative learning are inevitable. With effective design and implementation, the instructors are vital to creating and maintaining positive collaborative learning experiences among students.

## References

Azar, A. S., Keat, O. B., & Arutus, J. S. (2021). Collaborative learning in the classroom: The study of Malaysian University student' attitude. *Ilkogretim Online- Elementary Education Online*, *20*(4), 272-284. https://doi.org/10.17051/ilkonline.2021.04.30

Behfar, K. J., Mannix, E. A, Peterson, R.S., & Trochim, W. M. (2011). Conflict in small groups: The meaning and consequences of process conflict. *Small Group Res, 42*(2), 127–176.

Brannen, S. F., Beauchamp, D., Cartwright, N. M., Liddle, D. M., & Tishinsky, J. M. (2021). Effectiveness of group work contracts to facilitate collaborative group learning and reduce anxiety in traditional face-to-face lecture and online distance education course formats. *International Journal for the Scholarship of Teaching &Learning*, *15*(2), 1-12. https://doi.org/10.20429/ijsotl.2021.150205

Busch, M., Berg, J., & Zwaal, W. (2021). From on-site to online collaborative learning. *Research in Hospitality Management, 11*(3), 191-197. http://dx.doi.org/10.1080/22243534.2021.2006916

Butt, A. (2017). Quantification of influences on student perceptions of group work. *Journal of University Teaching and Learning Practice, 15*(5), 1-15. https://doi.org/10.2139/ssrn.3001625

De Backer, L., Van Keer, H., & Valcke, M. (2022). The functions of shared metacognitive regulation and their differential relation with collaborative learners' understanding of the learning content. *Learning and Instruction*, 77, 101527. https://doi.org/10.1016/j.learninstruc.2021.101527

Dewi, C. A., Erna, M. M., Haris, I., & Kundera, I. N. (2021). The effect of contextual collaborative learning based ethnoscience to increase student's scientific literacy ability. ***Journal of Turkish Science Education (TUSED),*** *18*(3), 525-541. https://doi.org/10.36681/tused.2021.88

Dindar, M., Järvelä, S., & Järvenoja, H. (2020). Interplay of metacognitive experiences and performance in collaborative problem solving. *Computers & Education*, 154, https://doi-org.ezproxy.lib.ucalgary.ca/10.1016/j.compedu.2020.103922.

Garrison, D. R. (2022). Shared metacognition in a Community of Inquiry. *Online Learning, 26*(1), 6-18. https://doi.org/10.24059/olj.v26i1.3023

Hadwin, A. F., Bakhtiar, A., & Miller, M. (2018). Challenges in online collaboration: Effects of scripting shared task perceptions. **International Journal of Computer-Supported Collaborative Learning, 13***(3),* 301-329. https://doi.org/10.1007/s11412-018-9279-9.

Han, F., & Ellis, R. A. (2021). Patterns of student collaborative learning in blended course designs based on their learning orientations: A student approaches to learning perspective. *International Journal of Educational Technology in Higher Education, 18*(1), 1-16. https://doi.org/10.1186/s41239-021-00303-9

Howard, L. W., Tang, T. L. P., & Austin, M. J. (2015). Teaching critical thinking skills: Ability, motivation, intervention, and the pygmalion effect. *Journal of Business Ethics, 128*(1), 133–147. https://doi.org/10.1007/s10551-014-2084-0

Isohätälä, J., Näykki, P., & Järvelä, S. (2019). Cognitive and socio-emotional interaction in collaborative learning: exploring fluctuations in students' participation. *Scandinavian Journal of Educational Research,* 1–21. https://doi.org/10.1080/00313831.2019.1623310

Janssona, M., Hrastinski, S., Stenbom, S., & Enoksson, F. (2021). Online question and answer sessions: How students support their own and other students' processes of inquiry in a text-based learning environment. *Internet and Higher Education, 51*, 1–10.

https://doi.org/10.1016/j.iheduc.2021.100817

Järvenoja, H., Järvelä, S., & Malmberg, J. (2020). Supporting groups' emotion and motivation regulation during collaborative learning. *Learning and Instruction, 70*, ArtID: 101090. https://doi.org/10.1016/j.learninstruc.2017.11.004

Kima, D., & Lim, C. (2018). Promoting socially shared metacognitive regulation in collaborative project-based learning: A framework for the design of structured guidance. *Teaching in Higher Education, 23*(2), 194-211. https://doi.org/10.1080/13562517.2017.1379484

Koretsky, M. D., Vauras, M., Jones, C., Iiskala, T., & Volet, S. (2021). Productive disciplinary engagement in high- and low-outcome student groups: Observations from three collaborative science learning contexts. *Research in Science Education*, Supplement 1, 1, 159-182. https://doi.org/10.1007/s11165-019-9838-8

Kurniasih, R., Sujadi, I., & Pramesti, G. (2016). The implementation of collaborative learning using AfL through fiving feedback strategy for improving students' attention to mathematics lesson. *Journal of Physics: Conference Series, 693*(1), 012018. https://doi.org/10.1088/1742-6596/693/1/012018

Linder, K. E., & Hayes, C. M. (2018). ***High-Impact practices in online education: Research and best practices.*** Sterling, VA: Stylus Publishing.

Lyons, K. M., Lobczowski, N. G., Greene, J. A., Whitley, J., & McLaughlin, J. E. (2021). Using a design-based research approach to develop and study a web-based tool to support collaborative learning. *Computers & Education, 161*, ArtID: 104064
https://doi.org/10.1016/j.compedu.2020.104064

McHugh, D., Hall, J. M., McLeod, K. M., Kovelowski, C. J., & Payne, A. M. (2020). ***Twelve tips for developing and implementing curriculum in dedicated 'collaborative classroom.' Medical Teacher,*** *42*(3), 266-271. https://doi.org/10.1080/0142159X.2018.1551992

Makani, J., Durier-Copp, M., Kiceniuk, D., & Blandford, A. (2016). Strengthening deeper learning through virtual teams in e-learning: A synthesis of determinants and best practices. *Journal of Distance Education (Online), 31*(2), 1-16.

Milman, N. B. (2015). Navigating online virtual group work: Tips for instructors and students. *Distance Learning, 12*(4), 51-54.

Sidorenkov, A. V., Borokhovski, E. F., & Kovalenko, V. A. (2018). Group size and composition of work groups as precursors of intragroup conflicts. *Psychology Research and Behavior Management, 11,* 511-523. https://doi.org/10.2147/PRBM.S178761

Strijbos, J. W. (2016). Assessment of collaborative earning. In G. T. L. Brown, & L. Harris (Eds.), *Handbook of social and human conditions in assessment* (pp. 302–318). New York: Routledge.

Sumadyo, M., Santoso, H. B., Sensuse, D. I., & Suhartanto, H. (2021). Metacognitive aspects influencing help-seeking behavior on collaborative online learning environment: A systematic literature review. *Journal of Educators Online*,*18*(3), 78-89.

[1] Tan, C. P., Van der Molen, H. T., & Schmidt, H. G. (2016). To what extent does problem-based learning contribute to students' professional identity development?. *Teaching and Teacher Education, 54*, 54-64.

Timonen, P., & Ruokamo, H. (2021). Designing a preliminary model of coaching pedagogy for synchronous collaborative online learning. *Journal of Pacific Rim Psychology.* 1-22. https://doi.org/10.1177/1834490921991430

Walston, S. L., & Johnson, K. L. (2022). *Organizational behavior and theory in healthcare* (2nd ed.). Chicago, IL: Health Administration Press.

Wang, Y., & Wang, Q. (2022). A student grouping method for massive online collaborative learning. *International Journal of Emerging Technologies in Learning, 17*(3), 18-33. https://doi.org/10.3991/ijet.v17i03.29429

Warsah, I., Morganna, R., Uyun, M., Hamengkubuwono, & Afandi, M. (2021). The impact of collaborative learning on learners' critical thinking skills. *International Journal of Instruction, 14*(2), 443-460. https://doi.org/10.29333/iji.2021.14225a

Wen, L. (2022). Influence of emotional interaction on learners' knowledge construction in online collaboration mode. *International Journal of Emerging Technologies in Learning, 17*(2), 76-92. https://doi.org/10.3991/ijet.v17i02.28539

Zhao, L., & Ye, C. (2020). Time and performance in online learning: Applying the theoretical perspective of metacognition. *Decision Sciences Journal of Innovative Education, 18*(3), 435–455. https://doi-org.ezproxy.lib.ucalgary.ca/10.1111/dsji.12216

Zimmerman, B. J. (2002). Becoming a self-regulated learner: an overview. *Theory Into Practice, 41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2