# METACOGNITIVE ASPECTS INFLUENCING HELP-SEEKING BEHAVIOR ON COLLABORATIVE ONLINE LEARNING ENVIRONMENT: A SYSTEMATIC LITERATURE REVIEW

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## ABSTRACT

*Metacognition has recently been used as an aspect of assessment in the development of learning, given its importance in improving the ability of students to solve problems. Collaborative online learning is a recommended form of learning because it fosters peer interaction. A higher frequency of interaction will improve the process of knowledge construction for an individual student. This process occurs because metacognitive activities are getting better. Metacognitive skills are also closely associated with help-seeking behavior. This article is a systematic review of the research conducted from 2009 to 2019 related to collaborative online learning, help-seeking behavior, and metacognitive skills. The purpose of this review is to identify and analyze the role of help-seeking behavior and the aspects of metacognitive skills developed in collaborative online learning. The results of the review show that there are various metacognitive aspects related to help-seeking behavior, and in the context of collaborative online learning, a variety of metacognitive aspects that are used to assess help-seeking behavior are found. Recommendations are also given at the end of this review.*

*Keywords: systematic literature review, collaborative online learning, help-seeking behavior metacognitive aspect*

## INTRODUCTION

Computer-based learning provides opportunities for students to be able to learn everywhere and use their learning more broadly. However, this learning will be effective if students manage their own learning by the process of metacognitive activities and self-regulation (Azevedo, 2005). Therefore computer-based learning, especially collaborative learning, can be considered as a collection of students' metacognitive activities (Walker et al., 2009). To improve learning so it is more productive, collaborative computer-based learning needs to improve its metacognitive quality by intervening in the form of introducing metacognitive strategies (Khosa & Volet, 2013). Thus, collaborative online learning requires a process of increasing metacognitive activities for the effectiveness of achieving learning objectives.

Besides being closely related to metacognitive learning, collaborative online learning is also related to help-seeking behavior (Kiefer & Shim, 2016). Help-seeking becomes an activity that is needed by students when experiencing difficulties with academic problems. Students will build relationships with someone to get help (Beisler & Medaille, 2016). Help-seeking was initially modeled by Nelson-Le Gall (1981) based on cognitive studies, then modified by Mercier & Frederiksen

(2008) according to the characteristics of the learning system. Finally, help-seeking is defined as one of the metacognitive activities for learning teaching materials and completing learning tasks (Chu et al., 2018). Thus, in fact both metacognitive and help-seeking behaviors play important roles in collaborative online learning.

Studies on metacognitive and help-seeking behaviors in the development of collaborative online learning have been carried out, but they are in a limited perspective, such as collaborative learning studies in the metacognitive perspective (Khosa & Volet, 2013; Kim & Lim, 2018; Smith & Mancy, 2018), or collaborative learning studies with help-seeking behavior perspectives (Du et al., 2015; Erkan et al., 2015). Whereas "metacognitive" and "help-seeking" are two terms that are related and mutually improve the quality of learning (Chu et al., 2018; Hauswirth & Adamoli, 2017), a collaborative online learning study with a metacognitive and help-seeking perspective requires a deeper study.

Research that examines metacognitive activities with help-seeking in collaborative learning has its own challenges. In addition to the complexity of its very diverse aspects, only a portion of research studies on collaborative learning with these two perspectives can be discussed in depth. Collaborative learning research alludes to these two perspectives, but only for the aspects that are limited to several metacognitive aspects (Hao et al., 2016). The development of collaborative online learning varies from year to year. Between 2009 and 2019, researchers conducted studies on collaborative online learning based on the completeness of the metacognitive regulations, which included monitoring, planning, and evaluating as well as the completeness in supporting help-seeking behavior.

This systematic literature review investigates several research papers that were published between 2009 and 2019. The aim is to identify and analyze metacognitive activities in help-seeking behavior in collaborative online learning. The identified metacognitive activities take precedence over the metacognitive aspects of a regulation. Meanwhile, the help-seeking behaviors identified are the interaction with fellow students and the behavior when using hints. Identification is also carried out on the independent variables to see their impact on learning outcomes.

## A REVIEW ON THE METHOD OF THE STUDY

In order to understand the current development of collaborative online learning, this study reviews papers published in Springer, Taylor & Francis, Science Direct, IEEE Xplore, and ACM Digital Library in a ten-year period: 2009–2019. The criteria used to choose articles for this study are: (a) the articles are based on empirical research results; (b) the articles are published in English; and (c) the main output is in the form of learning outcomes. The search for relevant articles on online databases was done by using the keywords "collaborative learning metacognitive" or "collaborative learning help-seeking."

Several reviews of collaborative learning have been carried out in the past four years. Among them are reviews that discuss two taxonomies; for example, there is a review of group formations and grouping techniques in collaboration (Maqtary et al., 2019), a review of the relationship between teacher guidance strategies and the process and outcome of collaboration between students (van Leeuwen & Janssen, 2019), a review of grouping criteria and grouping algorithms (Ge et al., 2018), reviews based on knowledge-building processes (Said et al., 2015), and reviews based on relevant concepts in coaching student interactions (Kaendler et al., 2015).

To date, there has not been any literature review about collaborative online learning that examines metacognitive factors in help-seeking behavior. This study focuses on the metacognitive factors of help-seeking behavior in collaborative online learning. This guideline summarizes the three stages in a systematic review: (a) the review plan, (b) the review process, and (c) the report of the review results. The research questions that guide this study are as follows:

1.  How do metacognitive activities affect collaborative online learning outcomes?

2.  How do help-seeking behaviors contribute to metacognitive activities?

3.  How do help-seeking behaviors play a significant role in collaborative learning and metacognitively influence learning outcomes?

## COLLABORATIVE LEARNING THEORY, HELP-SEEKING, AND METACOGNITION

There are three stages in the thinking

development process from divergent to convergent on collaborative learning theory, namely (a) generating ideas, (b) organizing ideas, and (c) intellectual convergence (Harasim, 2017). The process of generating ideas is achieved through brainstorming, verbalizing, and making information. Organizing ideas is done through clarifying and arranging new ideas that are in accordance with other ideas so that intellectual convergence occurs in the form of mutual understanding or beneficial contributions to the construction of knowledge. When students collaboratively go through complex conceptual spaces, they need metacognitive facilities to support the construction of collaborative knowledge (Hmelo-Silver, 2003).

One of the activities that supports metacognitive learning is help-seeking (Hauswirth & Adamoli, 2017). Help-seeking is differently defined between humans and nonhumans. Help-seeking with human assistance is in the form of metacognitive questions from the facilitator and students' collaborative interactions. While nonhuman help-seeking is an instrumental type of assistance in the form of hint facilities, i.e., explanations aimed at understanding the principle of resolution, it is not assistance to ask for ready-made answers (Puustinen & Rouet, 2009).

The role of friends in help-seeking activities in collaborative learning is very important for the development of academic beliefs and behavior. When the learning problems faced are beyond reach, students will tend to choose friends to ask for help (Shin, 2018). Figure 1 illustrates the development of metacognitive and help-seeking research in collaborative online learning.

A Summary of Research Trends on Metacognitive, Help-seeking, dan Learning Outcome

| Year | 1970 | 2000 | 2015 |
|---|---|---|---|
| **Metacognitive** | Cognitive Phenomena | Metacognitive Strategy | Metacognitive Collaborative Talk |
| | Model of Cognitive Monitoring | Metacognitive Intervention | Metacognitive Collaboration Learning |
| | Metacognitive Definition | Reciprocal peer Tutoring | |
| | Metacognitive Knowledge | | |
| | Metacognitive Regulation | | |
| | Metacognitive Experience | | |
| | Measure to Metacognition | | |
| **Help-seeking** | Activity finding out the environment learning | Help-seeking Tendencies | Collaboration Help-seeking |
| | Help-seeking as instrumental skill | Help Tutor | Help-seeking Performance |
| | Help-seeking as a process | Help Seeking Supplies | Adaptive Help-seeking |
| | Help-seeking Model | | |
| | Social and Cultural Norm on Help-seeking | | |
| | Measuring Willingness to Help-seeking | | |
| **Learning Outcome** | Effective Help-seeking Skill | Student Connectivity | Deep-level Regulation |
| | Aptitude Problem Solving | Student Metacognitive Regulation | Student Metacognitive Experience |
| | Achievement Goal | Student Social Metacognitive Regulation | Group Metacognitive |
| | Student Performance | Student Level | Student Perspective |
| | | | Collaboration Problem Solving |

Figure 1. Development of Metacognitive and Help-seeking Research

## RESULTS AND DISCUSSION

The analysis of the published research uses nonstatic methods to evaluate and interpret the results of the study. Based on the search strategy, a total of 349 papers were obtained, and 120 of them met the criteria. However, only 27 papers were accepted for the review (54 papers were rejected because they were not related to metacognitive activities or help-seeking behaviors, 30 papers were rejected because they were insignificant to learning outcomes, and nine papers were rejected because they were not relevant to the research questions).

This section discusses the relationship among collaborative learning, metacognitive activities, and help-seeking behaviors. This discussion only focuses on the 27 papers accepted for the review. Table 1 provides an illustration of how metacognitive activities and help-seeking behaviors become independent variables to influence learning outcomes. The following sections are the answers to the research questions.

**Research Question 1:** How do metacognitive activities affect collaborative online learning outcomes?

The research on collaborative online learning with an emphasis on metacognitive aspects has two major components. The first one is the metacognitive regulatory component. Experts divide this component into several aspects, such as planning, information management strategies, monitoring, debugging strategies, and learning evaluation (Schraw & Dennison, 1994). Later, this theory was revised by Moshman (2018), who divided it into three parts, namely planning (choice of strategy and allocation of resources), monitoring (online awareness about understanding and performance), and evaluation (assessing the results and the process of managing one's learning). In fact, Lai (2011) considered metacognitive regulation as a monitoring cognition that includes planning, awareness, and evaluation. The second component is metacognitive knowledge contained in declarative, procedural, and conditional knowledge (Schraw & Dennison, 1994) or one's self-knowledge cognition (Moshman, 2018). However, Lai (2011) considered cognitive knowledge as strategic knowledge or the knowledge about when and why to use the strategy. Besides these two components, Meijer et al. (2013) added another one, the responsive metacognitive component.

In this paper, the metacognitive activities we reviewed are limited to the metacognitive regulation with aspects of planning, monitoring, and evaluating. The reason is that the three aspects are most often involved in the reviewed papers. Therefore, in addition to the three aspects of metacognitive regulation, we consider other aspects. Our research has discovered that all papers on collaborative online learning that discuss the metacognitive factors of studying always involve the aspects of monitoring. They also include planning aspects (71%), evaluating aspects (57%), and other aspects (14%). Most of the research discusses learning performance and changes in students' metacognitive regulation. Mutual interaction between students has the potential to improve metacognitive regulatory skills (De Backer et al., 2015a). However, many students fail to translate the knowledge into metacognitive monitoring skills despite having adequate metacognitive knowledge (de Carvalho Filho, 2010). Therefore, other efforts are needed to help develop these skills, one of which is help-seeking behavior.

**Research Question 2:** How do help-seeking behaviors contribute to metacognitive activities?

Help-seeking behaviors used in collaborative online learning are the ones that play a role in learning how to succeed as oneself, not those that directly execute solutions to the problems (Nelson-Le Gall, 1985). There are two types of help involved. The first type is student interaction with other humans, which is the interaction between students and facilitators and the interaction between students. The second type is seeking nonhuman assistance, which is done using hints (Puustinen & Rouet, 2009). Online help-seeking is useful for training self-regulated learning skills (Liu, 2017). Help-seeking is also the type of metacognitive activity involving monitoring or evaluating the understanding of self-learning (Chu et al., 2018). Therefore, each stage of help-seeking activity is the stage for increasing metacognitive abilities. In fact, help-seeking is very important for teachers and facilitators to help students in metacognitive learning strategies (Karabenick & Newman, 2010). However, in contrast to the metacognitive activities that were previously targeted to students, these strategies have the potential to improve help-

seeking skills (Jansen et al., 2017). Hence, "help-seeking" and "metacognitive" are two terms that can be mutually causal. Help-seeking behaviors have the potential to improve metacognitive skills and in turn, the metacognitive encouragement for students will reinforce their help-seeking behaviors in collaborative learning.

The help-seeking behaviors reviewed in this paper are limited to the interactions between students. Moreover, the nonhuman help-seeking activity is limited to the search for hints in collaborative online learning. This study has found that some papers examine help-seeking behaviors in student interactions (64%), and some papers examine help-seeking activities using hints (44%). However, the form and evaluation of interactions studied vary. Research conducted by Kiefer & Shim (2016) and Shin (2018) assessed the longitudinal relationship in help-seeking interactions among students with the focus on their social goals or the influence of friends. Student interaction can also be assessed in the form of classroom script. The classroom-script structure has a substantial effect on help-seeking behavior (Mäkitalo-Siegl & Fischer, 2011).

**Research Question 3:** How do help-seeking behaviors play a significant role in collaborative learning and metacognitively affect learning outcomes?

As previously mentioned, "help-seeking" and "metacognitive" are two terms that are mutually causal in collaborative online learning. Some experts claim that the two terms are learning strategies with an integral scale as the resource management and cognitive strategies (Pintrich et al., 1991). In the context of resource management, Wosnitza et al. (2015) examined the help-seeking behavior between groups compared with intragroup. The results affected the development of independence, collaboration, and problem-solving skills in class management. However, no literature that examines the characteristics of metacognitive help-seeking in collaborative learning in more detailed has been found. From 27 papers reviewed, there were only three papers that discussed help-seeking with a metacognitive perspective, and even then, only one paper was tested in a collaborative learning group (see Table 1).

Individually, students with high metacognitive abilities show better performance and self-confidence (de Carvalho Filho, 2010), since high cognitive activity is always preceded by high metacognitive abilities (Molenaar & Chiu, 2015). Consequently, if a collaborative intervention is conducted by utilizing metacognitive abilities, the problem-solving skills will improve rapidly despite the high level of difficulty (Sandi-Urena et al., 2011). Collaborative interventions can be performed in computerized scripts that provide guidance for group interactions so as to encourage individual metacognition processes through the collaborative design phase (Chen & Chiu, 2016) and are significantly related to metacognitive regulation (De Backer et al., 2017). Thus, metacognitive activities affect the results of online collaborative learning and vice versa.

Help-seeking can be reviewed from two factors: student factors and context factors that affect students (Schworm & Gruber, 2016). Factors related to students are student role identity in groups (Du et al., 2015) and student interactions in group cognitive processes (Gu et al., 2015) that affect the performance of collaborative learning groups (Walker et al., 2009). Likewise, the academic quality of students (Ryan & Shin, 2011) and students' goals for mastering learning are positive predictors of help-seeking activities, and, vice versa, students who only aim not to be the worst students become negative predictors (Roussel et al., 2011). Meanwhile, context factors that affect students such as instructional consequences and group work challenges are positively related with collaborative learning group performance (Du et al., 2015). Student interaction in collaborative learning groups significantly improves metacognitive regulation of monitoring, evaluation, and orientation (De Backer et al., 2012, 2015a). In interactions, friends who are asked for help are those who have similarities in persistence, effort, challenge-seeking, and independent learning strategies (Shin, 2018). Although there is no significant difference between pretest and posttest in metacognitive knowledge, there are significant changes in metacognitive regulation (De Backer et al., 2012). Thus help-seeking behavior has a significant contribution to metacognitive activities, especially in metacognitive regulation.

Help-seeking is designed to make students become independent in learning (Aleven et

al., 2016) and improve their skills in seeking help (Erkan et al., 2015; Roll et al., 2011). Help-seeking is positively related to the effectiveness of collaborative learning (Walker et al., 2009). Help-seeking patterns can be arranged through the structure of class scripts in collaborative inquiry learning (Mäkitalo-Siegl et al., 2011). Even though there is a written script, the facilitator or teacher is not allowed to refuse requests for help from students (Wosnitza et al., 2015). Some activities in collaborative learning that suit help-seeking activities that significantly affect metacognitive activities are asking and explaining to each other in group discussions (De Backer et al., 2015b; Smith & Mancy, 2018), observing group members to ask for possible help (Biasutti & Frate, 2018; De Backer et al., 2016), using collaboration scripts (Kim & Lim, 2018), and fostering collaboration attitudes (Jin & Kim, 2018). However, groups with high social network connectivity have advantages in cognitive and metacognitive strategies (Lawanto & Santoso, 2013). Therefore, help-seeking behavior plays a significant role in collaborative learning and metacognitively affects learning outcomes.

Table 1 illustrates that in collaborative learning there is one aspect, the monitoring aspect, that is always a measure in assessing metacognitive activities, while the planning and evaluating aspects are not always a measure even though most learners use it. The variables mostly use metacognitive activities to determine student performance. While research involving help-seeking behavior has made use of aspects of interaction between students balanced with aspects of using hints in seeking help, not many involved put these two aspects together as variables in the study. Most of the research uses group behavior variables and individual metacognitive activities to determine student performance and help-seeking skills.

### FUTURE DIRECTIONS FOR RESEARCH

Collaborative online learning research by investigating metacognitive skills and social networking has been carried out to examine the monitoring and learning management strategies (Lawanto & Santoso, 2013). A similar study has been carried out by Molenaar and Chiu (2015), which found that planning strategies in groups with certain cognitions affect group performance. Metacognitive studies for collaborative learning

are also used in nursing practice (Aiguier et al., 2015), whereas Junus et al. (2015) used metacognitive aspects of Linear Algebra learning to examine the presence of these aspects in face-to-face meetings and online discussions. The metacognitive aspects of collaborative online learning encourage students to be more aware of their attitude of learning independently so that it is no longer limited to instructional packages (Gulati, 2013). In the context of collaborative learning, metacognitive aspects can be seen as socio-metacognitive, which is the ability of students to monitor and regulate activities related to the development of the classroom environment that is improved over time (Borge & White, 2016).

In this review, we found no collaborative online learning paper that examined the metacognitive activities of human help-seeking behavior together with nonhuman help-seeking. Metacognitive feedback has been investigated as an aspect of monitoring in help-seeking behavior by using hints (Roll et al., 2011), and even then, it is still limited to intelligent tutoring systems, not to collaborative learning. Help-seeking in an intelligent tutoring system is different from help-seeking in the classroom (Vaessen et al., 2014). Although the differences are not completely clear, both include collaborative learning.

Further study can be conducted to examine whether collaborative online learning pays more attention to human and nonhuman help-seeking behaviors in improving metacognitive skills. Furthermore, improving the quality of help-seeking behaviors can be studied to see whether it will improve metacognitive skills and significantly affect the quality of collaborative learning. Whether human help-seeking and nonhuman help-seeking behaviors stimulate one another should be researched more. In addition, the question about which metacognitive aspects are the closest to help-seeking behaviors in collaborative online learning can also become a research theme to develop further.

### CONCLUSION

This paper presents a systematic literature review of help-seeking metacognitive factors in collaborative online learning. The review has illustrated that help-seeking behavior, metacognitive activities, and collaborative online

learning have a significant relationship even in different aspects and components.

Although there is no collaborative online learning study that studies metacognitive activities on human help-seeking behavior along with nonhuman help-seeking, our review has obtained metacognitive components and help-seeking factors to improve learning performance and learning behavior. The results of this study provide recommendations as an analytical material for collaborative learning modeling with metacognitive and help-seeking aspects to improve learning performance.

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# TABLE

Table 1. The Distribution of Studies on Metacognitive Help-seeking in Collaborative Online Learning

| No | Author | Metacognitive | | | | Help-seeking | | Independent Variable | Dependent Variable |
|----|--------|:-:|:-:|:-:|:-:|--------------|------|---------------------|--------------------|
| | | P | M | E | 0 | Interaction. | Hint | | |
| 1. | (Walker et al., 2009) | | | | | | Help tutor | AA & MF | SP |
| 2 | (de Carvalho Filho, 2010) | | ✓ | | | | | ML | SP |
| 3 | (Sandi-Urena et al., 2011) | | ✓ | ✓ | | | | MI | Strategy, Ability, SR, SRp |
| 4 | (Mäkitalo-Siegl et al., 2011) | | | | | Classroom-script | | Classroom-script Structure | HS Process |
| 5 | (Roussel et al., 2011) | | | | | HS approach & avoidance | | Mastery Performance Attitude | AG & SG |
| 6 | (Ryan & Shin, 2011) | | | | | | HS behavior | Prior GPA Achievement SG | HS tendencies |
| 7 | (Roll et al., 2011) | | | ✓ | | | HS Errors | MF | HS Skills |
| 8 | (De Backer et al., 2012) | ✓ | ✓ | ✓ | | | | RPT | SMR |
| 9 | (Lawanto & Santoso, 2013) | ✓ | ✓ | | ✓ | | | Cognitive Strategies Metacog Strategies Regulation Strategies | SC |
| 10 | (De Backer et al., 2015b) | ✓ | ✓ | ✓ | | | | Content processing Transactive discussions | SSMR |
| 11 | (Molenaar et al., 2014) | ✓ | ✓ | ✓ | ✓ | | Scaffolding | MS | IGSMI |
| 12 | (De Backer et al., 2015a) | ✓ | ✓ | ✓ | | | | SMR | DLR |
| 13 | (Molenaar & Chiu, 2015) | ✓ | ✓ | | | | | MP | GP |
| 14 | (Du et al., 2015) | | | | | Student level Group level | | Peer-oriented reason Group work interest | SA |
| 15 | (Gu et al., 2015) | | | | | Role Group | | 12 role group | CPS |
| 16 | (Erkan et al., 2015) | | | | | | Online HS | Flipped Classroom | SPr |
| 17 | (Wosnitza et al., 2015) | | ✓ | | | Role Group | | Intergroup Intragroup | SD, CPS |
| 18 | (Aleven et al., 2016) | | | | | | ITS | Cognitive Metacognitive SRL Motivation | HS Skills SP |
| 19 | (De Backer et al., 2016) | ✓ | ✓ | ✓ | | | | RPT-Group | DLR |
| 20 | (Chen & Chiu, 2016) | ✓ | ✓ | | | | | MR | SP |
| 21 | (De Backer et al., 2017) | ✓ | ✓ | ✓ | | | | DLR | RPT participants |
| 22 | (Smith & Mancy, 2018) | | ✓ | | | | | Collaborative talk Metacognitive talk | SX |
| 23 | (Kim & Lim, 2018) | ✓ | ✓ | ✓ | | | | P, M, E | SMX |
| 24 | (Jin & Kim, 2018) | | ✓ | | | | | MR | Aspect of SPS |
| 25 | (Biasutti & Frate, 2018) | ✓ | ✓ | ✓ | ✓ | | | P, M, E, 0 | GM |

| 26 | (Shin, 2018) | | | | LA | | Friend Role | HS tendencies |
| 27 | (Schworm & Gruber, 2016) | | | | Adaptive HS | | GO, EB, LS | HS performance |

Note. P=Planning; M=Monitoring; E=Evaluating; Other=Orientation, Reflection, Metacognitive Knowledge; AA=Adaptive Assistance; AG=Achievement Goals; CPS=Collaborative Problem Solving; DLR=Deep-level Regulation; EB=Epistemic Belief; GO=Goal Orientations; GP=Group Performance; GM=Group Metacognition; HS=Help-seeking; IGSMI=Intragroup Social Metacognitive Interaction; ITS=Intelligent Tutoring Systems; LA=Longitudinal Association; LS=Learning Strategies; MF=Metacognitive Feedback; ML=Metacognitive Level; MI=Metacognitive Intervention; MP=Metacognitive Planning; MR=Metacognitive Regulation; MS=Metacognitive Scaffolding; SA=Student Achievement; SC=Student Connectivity; SD=Self-Directness; SG=Social Goals; SMR=Student Metacognitive Regulation; SMX=Student Metacognitive Experience; SP=Student Performance; SPr=Student Perspective; SPS=Scientific Problem-Solving; SR=Solve Rate; SRp=Self-reported; SSMR=Socially Shared Metacognitive Regulation; SX=Student Experience; RPT=Reciprocal Peer Tutoring.