Teaching presence: how to facilitate online collaborative learning in higher education?

A systematic literature review

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Introduction

Partly due to the corona pandemic, teachers are increasingly using online education in their courses. It is expected that also in the future, teachers will make use of the opportunities which online contact offers us and therefore continue to incorporate online learning activities. A specific application of online education is the use of Collaborative online international learning (COIL) for the purpose of *internationalisation@home*. Online, students can easily interact with students from other countries and develop intercultural competences. Precisely because of all these possibilities online, it is important to understand how online education can be supported by teachers to achieve authentic and meaningful learning.

This whitepaper discusses how teachers can facilitate collaborative learning online. We define collaborative learning as *'a situation in which two or more people learn or attempt to learn to achieve a common goal or solve the task at hand, mostly through peer-directed interactions'* (Dillenbourg, 1999). This form of learning, grounded in social constructivism, assumes that students actively participate and interact with each other. According to social constructivism, knowledge is constructed through interaction and therefore a social product. More specifically, individuals create meaning through interaction with each other and with their environment. Active learning can contribute to knowledge construction by helping the student to connect their newly acquired knowledge to previous (learning) experiences. For example, students together can ask each other questions, find connections between learning materials and think critically about a given problem. This active process of actively linking new knowledge to existing knowledge is useful, because it helps to store knowledge in a way that it can be easily retrieved from memory. It is called 'deep learning' (Biggs & Tang, 2011; Johnson & Johnson, 1999).

In addition to facilitating deep learning, collaborative learning is important for community building among students. Community building supports a sense of belonging, one of the basic human needs next to a sense of competence and autonomy (Deci & Ryan, 2000). Together, these basic needs strengthen motivation, and motivation in turn enhances learning. Positive interactions with peers (social connectedness) and teachers and staff (academic connectedness) ensure that students feel at home and safe within their study program as well as comfortable to ask questions. It also minimizes the chances of dropping out (Tinto, 1992; Tinto, 1975).

Online collaborative learning can be difficult because of the distance people can perceive, both during asynchronous and synchronous contact. In literature on so called *transactional distance*, Moore (1997, 2013) describes that distance learning not only involves physical distance and a distance in time, but that students can also experience a psychological distance and communicative gap that separates the teacher from them as learners. Therefore, it is important that the teacher invests in reducing transactional distance by facilitating social interaction. This goes beyond facilitating interactions for the purpose of learning, such as assigning students to groups. The teacher should better guide his or her students throughout the whole process of collaborative learning. However, this can be especially challenging in an online setting.

In an asynchronous online collaborative learning setting, students feel more confused, experience less participation and group cohesion and are less satisfied than in face-to-face collaborative learning (Kreijns 2020, p39). Collaboration is more time-consuming; students experience more conflicts than in face-to-face education; and they are less productive. Students also regularly fail to build on each other's input: many students do not read each other's input and do not respond to each other. Kreijns (2020) also discusses that if a teacher grades the collaborative process, the quality remains low and it takes the teachers a lot of time to review.

Also in synchronous online collaborative learning there are differences with a face-to-face setting because the teacher does not oversee all groups. Intervening and asking questions online is different: questions-answer exchange is slower, and questions are mostly addressed to the entire group or one student in specific (whereas in a face-to-face setting you can use body language to give turns more subtly).

Because of these challenges for online collaborative learning, teachers in higher education would benefit from tools for facilitating online collaborative learning that are grounded in educational literature (i.e. evidence-informed strategies). If teachers can use such tools in their course design where online collaborative learning is applied, this will benefit both student learning and their sense of belonging within the program.

By means of a literature review described in this white paper, we wish to help teachers make informed choices regarding the design and facilitation of collaborative learning in online education. Th research questionthat we aim to answer through our literature review is: "*What strategies can teachers [in higher education] use to facilitate online interaction for collaborative learning*?" Our study is focused on the role of the teacher, i.e. the pedagogical-didactical strategies that teachers can apply on online collaborative learning. We are not concerned with choosing or designing the platforms on which the learning takes place or the work formats within which the learning activities are designed.

Theoretical models of the teacher's role in online collaborative learning

Community of Inquiry

In order to define the role of the teacher in facilitating online collaborative learning, we use the Community of Inquiry model (COI) from Garrison, Anderson & Archer (2000; 2001). The model focuses on building a learning community in which students collectively construct meaningful and valuable knowledge. The basis of the model is that deep and meaningful learning in online education can be achieved by developing three forms of 'presence': social presence, cognitive presence, and teaching presence (see also figure 1). To be clear, presence here refers to the *perception* of social, cognitive and teaching presence.

Social presence refers to the extent to which learners perceive themselves and others as "real people" in online communication (Kreijns, 2020). This can be particularly difficult asynchronously, because direct communication is missing, but also during synchronous communication where non-verbal aspects of communication are largely missing. *Cognitive presence* is about the extent to which learners experience that they are able to learn through online interaction. Participants reflect on and discuss the learning material together, which provides meaning. Finally, *teaching presence* is defined as students' perception that social and cognitive presence are both facilitated by shaping and guiding the interaction between students with the aim of achieving valuable learning outcomes. This is often the responsibility of the teacher, but the role can also be taken on by students. Teaching presence thus appears to play a central role in establishing the other presences and the perception of those (Garrison et al., 2010).

Increasing teaching presence

Redmond and Locke (2006) elaborated on the COI model and indicated that teaching presence can be increased at three levels: design and organization, facilitating discourse and direct instruction (see figure 1).

Design and organization is about planning and designing the structure, collaborative process, interaction and assessment of the online course. In online education, design and organization need to be well thought through and communicated to the students because the indirect communication makes it harder to deal with ambiguities (Moore, 2013). Moreover, the norms of the regular classroom are missing. It is possible to make some adjustments during a learning activity, but it is better to arrange this well in advance, for example by designing collaborative activities and discussion assignments.

Facilitating discourse is about the way students interact about, and build upon, the course material. By appreciating student input, clarifying ideas, identifying areas of agreement and disagreement, and striving for consensus and understanding, the teacher stimulates the learning process.

Direct instruction involves intellectual and scientific supervision of the teacher (or the person who takes on the teaching role). The teacher shares knowledge and directs the content of discussion by focusing on a specific topic or summarizing it. The teacher must be able to tell from the discussion among students whether they have understood the material. If the discussion remains too superficial, he or she must be able to fuel it with insights and references to literature. In other words, this entails more than just a facilitator's role. As content expert, the teacher is involved in the student's knowledge development. Using their knowledge of the subject matter, they can gradually guide students to a higher level of understanding. In addition to this content-related guiding role, the teacher also influences the learning process by encouraging reflection and feedback and by assessing student performance.

In addition to these three levels, according to Redmond and Lock's model, teaching presence is also about 'creating and sustaining a learning community' and 'scaffolding learning'. *Creating and sustaining a learning community* involves the processes and activities directed at forming and maintaining a learning community, such as being aware of group composition (in the design phase) and setting an example (during the course). Through these kinds of activities, the teacher contributes to shaping social presence.

Scaffolding learning refers to what teachers do to connect to students' level of understanding and their interventions during the collaborative process in order to enhance critical thinking. By carefully guiding students towards a higher level of understanding, teachers shape cognitive presence (see figure 1).

To summarize, we have found five teaching presence elements in Redmond & Locke's model that describe what an teacher needs to focus on to shape teaching presence (Garrison et al., 2000; Redmond & Lock, 2006):

1. Design and organization;
2. Creating and sustaining a learning community;
3. Facilitating discourse;
4. Scaffolding learning; and
5. Direct instruction

Some strategies relate to the **design phase** of a course or course element (1-2), others relate to facilitating the interaction process **during** the course (2-5). These five elements correspond to the broader educational literature on what types of strategies teachers can use to fulfill their roles in the classroom. This framework provides us with a sound theoretical basis to start our literature search.
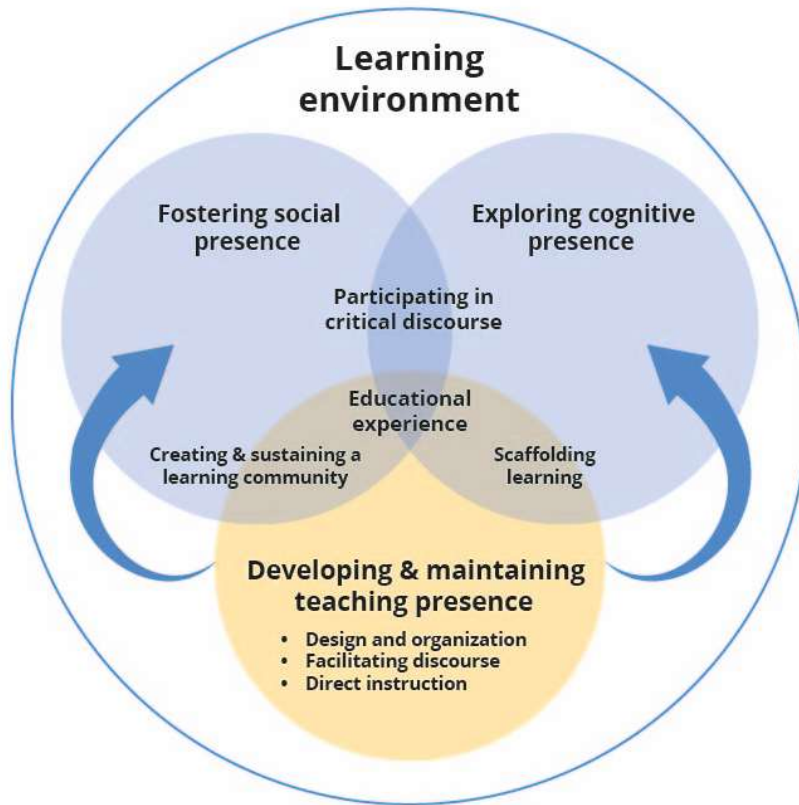
Figure 1: Integrated theoretical model

Methods

For this systematic literature review, we used search engines PsychInfo, ERIC, and Scopus. Our search strategy was as follows: for each element in the research question ("*What strategies can teachers [in higher education] use to facilitate online interaction for collaborative learning*?") we used the subject headings to look for alternative and related terms in the thesaurus of the search engines. Then we established inclusion criteria appropriate for the scope of the study: journal articles, peer reviewed, in English and published between 2011 and September 2020, higher education, Western countries. The PsychInfo, ERIC and Scopus databases were consulted in November 2020. This search provided a set of 525 papers. This set of papers was narrowed down by selecting the papers focusing specifically on the teacher's role in online collaborative learning, which ultimately resulted in a set of 43 papers. Finally, the content (e.g. research questions) and methods of these papers were studied more closely in order to decide on their relevancy, leaving us with 17 relevant papers. From these papers the reference lists were screened for interesting additions, which yielded two additional papers. Finally, we applied a quality check to this set of 19 papers (Boeije, 2011). Two papers were excluded from inclusion because of insufficient quality. For an overview of the steps taken to come up with this selection, see figure 2 (flow diagram).
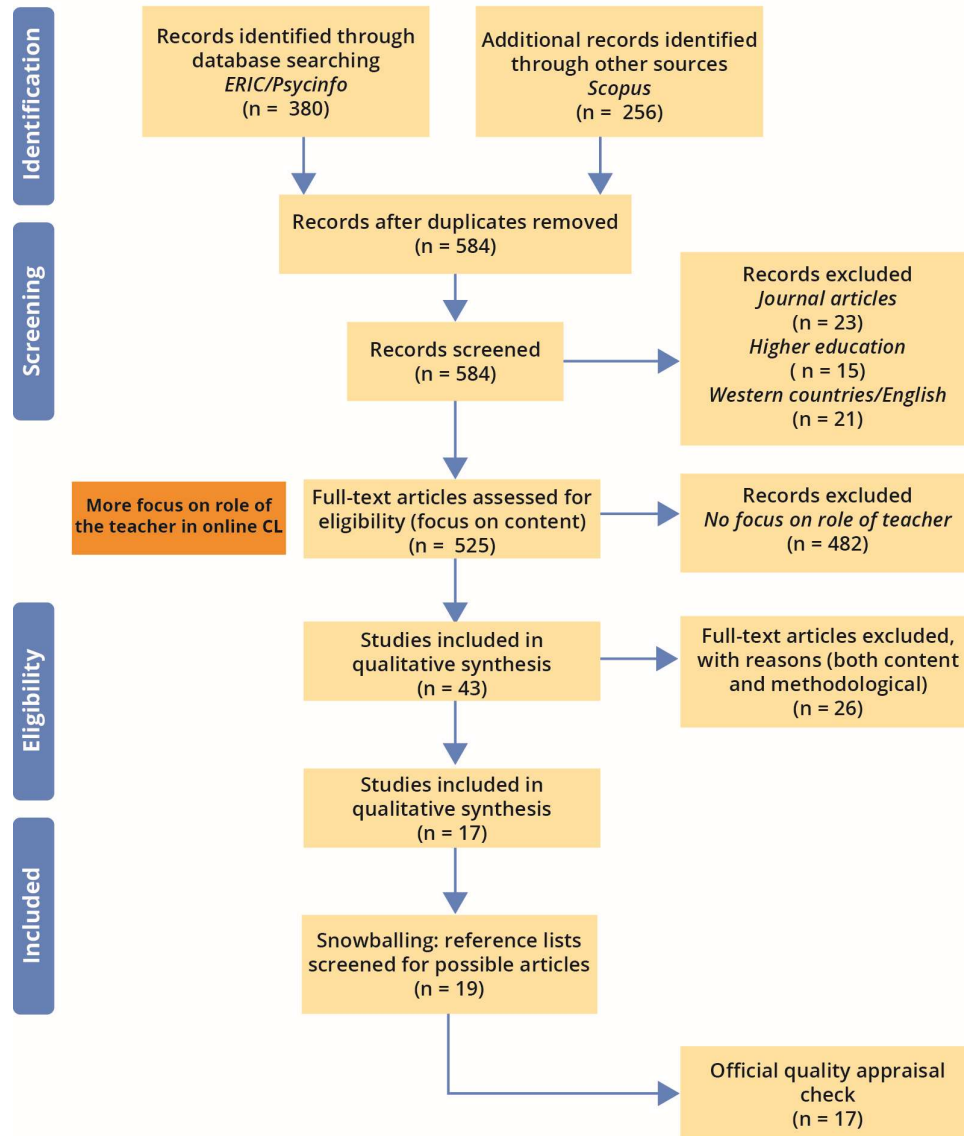
Flow Diagram: Teaching strategies for online CL

Identification	
Records identified through database searching *ERIC/Psycinfo* (n = 380)	Additional records identified through other sources *Scopus* (n = 256)

Screening

Records after duplicates removed (n = 584)

Records screened (n = 584) → Records excluded *Journal articles* (n = 23) *Higher education* (n = 15) *Western countries/English* (n = 21)

Eligibility

More focus on role of the teacher in online CL

Full-text articles assessed for eligibility (focus on content) (n = 525) → Records excluded *No focus on role of teacher* (n = 482)

Studies included in qualitative synthesis (n = 43) → Full-text articles excluded, with reasons (both content and methodological) (n = 26)

Studies included in qualitative synthesis (n = 17)

Included

Snowballing: reference lists screened for possible articles (n = 19)

Official quality appraisal check (n = 17)

Figure 2. Flow diagram

Data Analysis

During analysis, we focused on identifying strategies that teachers can use prior to and during instruction to facilitate interaction within online collaborative learning. We used the theoretically relevant 'teaching strategies' as described in the introduction as our analytical lens (Boeije, 2011). The data were coded systematically and step-by-step. This means that we compared and contrasted the results until themes emerged from the data that could answer our research question a common method in social science research. The qualitative analysis consisted of several steps, which we will describe below:

- **Step 1: Extracting data**. Highlight parts in the results sections of the papers that deal with the strategies used by the teacher to facilitate interaction during collaborative learning in online education.

- **Step 2: Summarizing data**. Ensure that both quantitative and qualitative expressions in the results sections of the papers are summarized in a summarizing sentence, e.g. "Strategy X to enhance Y (in online social interaction) for collaborative learning setting n" (Van Leeuwen & Jansen, 2019). These summarizing sentences served as the first coding step. To give an example: if a paper mentioned something about a successful intervention with a certain effect size, we turned it into a summary sentence with the following meaning: 'Strategy X1 is positively related to behavior Y1 among students in setting n'.
- **Step 3: Linking to 'teaching presence' category.** For each summarizing sentence we indicated to which of the five teaching categories it referred to, for example 'designing and organization' or 'facilitating discourse'.
- **Step 4: Searching for themes in summarizing sentences.** The summarizing sentences within each category were compared in order to look for overarching themes in the identified strategies and to look how these strategies aimed at benefitting students (e.g. increasing interaction, knowledge sharing, or building a community).
- **Step 5: Evaluating the indicated themes**. We then reviewed the themes in light of the theories on online collaborative learning to check for interesting variation in the data (e.g. synchronous versus asynchronous communication).

Results

Table 1 provides an overview of the descriptive statistics for the seventeen papers found: the authors and title of the study; the setting of the study described; methods and aim of the study.

Within the seventeen papers, we identified a total of forty pedagogical-didactical strategies relating to 'developing and maintaining teaching presence'. From these, the majority (70%) related to the strategies for designing and organizing teaching. Approximately one-fifth (18%) of those forty strategies also related to facilitating conversation among students (supporting discourse), one-tenth (8%) were related to 'creating and maintaining a learning community' and five percent of the identified strategies were aimed at scaffolding learning. Finally, we did not identify any strategy related to 'direct instruction'.

Hence, most strategies for teaching presence relate to the teacher's role in designing and organizing online education (*prior* to the course). Fewer strategies were identified that concerned the teacher's role *during* the course, such as facilitating conversation among student (e.g. enthuse students, ask questions). This may be because the research into online collaborative learning included in this review (2011 to 2020) focused primarily on the role of the teacher in asynchronous activities, for example supervising asynchronous discussions on forums, while little was found regarding synchronous learning activities.

In the following sections, we will use illustrative examples to describe the strategies found regarding the teacher's role prior to and during online education.

Table 1. Overview of studies included in the systematic review

Reference: author, year, title	Setting : • Country • Discipline, Ba/Ma, course length • (a)synchronous/blended • N	Method	Goal of the study
Cacciamani et al. (2019), Effects of a social tutor on participation, sense of community and learning in online university courses	• Italy • Experimental Pedagogy, Ba, 3 months course • blended (face to face and asynchronous online) • N = 53 (of 77 students in total)	quantitative study; survey	Explore if assigning a student the specific social tutor role could (1) encourage peers participation in online discussion; (2) promote the development of any dimensions of sense of community; and (3) support effective learning with reference to course topics.
Cesareni et al. (2016), Role taking and knowledge building in a blended university course	• Italy • Pedagogy, first-year Ba, 3 consecutive 5-week modules;, discussion groups of 10-12 students • Blended (face to face and asynchronous online) knowledge building activity (voluntarily) in addition to lectures • study 1 (Q1): N = 59; study 2 (Q2-4): N = 143	study 1: experimental design study study 2: qualitative content analysis	Does taking on a role in a group in an online course lead to a higher level of participation in knowledge building in terms of writing and reading activity? 2. Which specific types of roles foster a higher level of participation? 3. Does taking on a role influence the conversational functions of the messages students post compared with those posted by students who do not take a role? 4. Are there also differences between roles in the conversational functions of the messages posted?
Draper (2015), Collaborative Instructional Strategies to Enhance Knowledge Convergence	• US • Education (instructional technology), graduate level, 14-week course • Blended (face to face and synchronous & asynchronous online) • N = 20	qualitative case study	Demonstrate collaborative instructional strategies that promote knowledge convergence in digital environments.
Ekwunife-Orakwue & Teng (2014), The impact of transactional distance dialogic interactions on student learning outcomes in online and blended environments	• US • School of Professional Development, Technology and Society, Global Operations Management, Electrical Engineering; graduate, undergraduate, certificate, nondegree, alumni; multiple courses in a three-year period • synchronous or asynchronous; online or blended • N= 342 students	survey; quantitative study	Dialogic interactions should result in increased student learning outcomes. Will the individual differences that have been posited to influence perceived distance, influence dialogue in the same direction irrespective of the media?

Gasevic et al. (2015), Externally-facilitated regulation scaffolding and role assignment to develop cognitive presence in asynchronous online discussions	• Canada • Software engineering, Ma, 13 week course • asynchronous online discussions in a fully online course • N = 82 (distributed over 6 course offerings)	quasi-experimental mixed design	RQ1: what is the effect of external motivation and external regulation standards on the development of cognitive presence? RQ2: can we build effective student-led discussions through role assignment?
Gonzales et al. (2019), From monologue to dialogue: Creating a community of inquiry in online ecological restoration courses	• US • Biodiversity and Conservation Biology; Ba; 3rd year course, 5 modules • Asynchronous discussion in online course • N = 117 (distributed among 19 groups, over 3 years	experimental design study	Shift an asynchronous online discussion from "shared monologues" toward dialogue.
Guasch et al. (2013), Effects of feedback on collaborative writing in an online learning environment	• Catalonia • psychology, Ba, 15 week course • asynchronous • N=201	quasi-experimental design: intervention study with a pretest, quantitative	RQ1: What type of feedback and feedback-giver will best improve the quality of collaborative writing products? RQ2: what effects do teacher and peer feedback have on student learning in an environment based on asynchronous written communication?
Kumi-Yeboah (2018), Designing a Cross-Cultural Collaborative Online Learning Framework for Online Instructors	• US • different academic disciplines (Education, Social Science, Science, Public Health), from 2 universities, online/blended courses • synchronous & asynchronous • N = 40	mixed method: qualitative interview data from instructors (F2F semi-structured interviews), observations, course documents	How do instructors design instructional strategies to promote cross-cultural collaborative online learning?
Kwon et al (2018), Effects of graphic organizers in online discussions: Comparison between instructor-provided and student-generated	• US • instructional design, 12 week course, online • asynchronous • N = 36	quasi-experimental study	RQ1: Do students demonstrate the higher level of knowledge construction in online discussions when receiving or generating graphic organizers? RQ2: What are the different effects of the two approaches, receiving versus generating graphic organizers, on the level of knowledge construction?
Linjawi et al. (2012), Online discussion boards in dental education: Potential and challenges	• UK • Prosthetics (School of Dentistry), undergraduate, voluntary online discussion board in e-course (anonymous but difference between student and teacher is clear) • asynchronous • records from the discussion board of the year 2008 (students and teachers)	qualitative study	Explore the dynamics of using online discussion boards and investigate methods of maximizing their success in dental education.

Sansone et al. (2018), Peer e-tutoring: Effects on students' participation and interaction style in online courses	• Italy • 15 week blended learning course • N = 18 (of which 12 participating in e-tutor role)	case study (contributions posted, analysis of e-tutor self-assessment forms) + quantitative analysis of posts	Promote active participation in online courses by supporting students in performing the role of an e-tutor during group activities.
Sobko et al. (2020), Learning through collaboration: A networked approach to online pedagogy	• US • educational psychology, Ba, online course • synchronous • N = 31 (students, 1 high school senior): This paper: one group of 3 students.	qualitative study, thematic coding	Explore what constitutes networked collaborative learning in an online classroom and the roles that different actants play in mediating this process.
Weinberger et al. (2013), Inducing socio-cognitive conflict in Finnish and German groups of online learners by CSCL script	• Finland and Germany • Educational Psychology, Ba, 3 hour experimental sessions in an online course • synchronous • N = 132 (mixed Finnish and German groups of 3)	quasi-experimental, cross cultural study	Examine to what extent cultural differences can be found on the level of learning activities during online discussions and subsequently on knowledge acquisition. In addition, examine to what extent instructional means may have different effects on processes and outcomes of learning within different cultures.
Wise & Chiu (2014), The impact of rotating summarizing roles in online discussions: Effects on learners' listening behaviors during and subsequent to role assignment	• Canada • Educational Psychology, Ba, online course • asynchronous • N = 33 out of 95 students in total (6 week long discussions in groups of 10 students)	quantitative analysis; temporal analysis; online questionnaire	RQ1: Does being assigned a summarizing role impact students' listening behaviors in an online discussion during their assigned role week? RQ2:. Are any effects of summarizing roles sustained in subsequent weeks when the role is no longer assigned? RQ3: Are there any other changes in listening behaviors in weeks subsequent to that of the role-assignment?
Wise & Hsiao (2019), Self-regulation in online discussions: Aligning data streams to investigate relationships between speaking, listening, and task conditions	• Canada • Business, Ba, blended (face to face, online) • asynchronous • N = 105 (of 157) small-group	Experimental design study	In small-group online case-based discussion: RQ1: What effects does task type have on how students attend to others' posts (their "listening" behaviors)? RQ2: What relationships exist between how students attend to others' posts and the qualities of the posts they make themselves? RQ3: Are relationships between students' listening and speaking behaviors moderated by the task type?
Xie & Ke (2011), The role of students' motivation in peer-moderated asynchronous online discussions	• US • Instructional Technology, split-level (age 19-46), online course • asynchronous • N = 23 (small groups of 6-8 students)	Mixed method (qualitative analysis of online discussions, survey questionnaires)	Examine whether and how peer moderators' motivation impact their own moderation performance, and consequently their peers' online interaction and learning.

Xie et al. (2014), Impacts of role assignment and participation in asynchronous discussions in college-level online classes	• US • Instructional Technology, Ba, online course, 4 sections of the course (with 12-16 students each) • asynchronous • N = 57	Mixed method (participation data, social network analysis, qualitative analysis of cases)	Examine the role of assigned discussion moderators and analyze the moderator-to-peer relationship among students in a peer-moderated asynchronous online learning environment.

Course design

Based on the scientific research included in this literature study, the identified strategies mainly relate to course design, which generally involves thinking in advance about how to organize and structure the interaction between students. In the papers used for this review they are also referred to as 'instructional strategies', because as a teacher you build them into the instructional design of the course in order to organize and structure collaborative learning and interaction (e.g. Draper, 2015). By thinking in advance about how to design dialogue between students, you are consciously applying 'teaching presence' to create an authentic, meaningful learning experience. From the literature we distilled two instructional strategies that you, as a teacher, can use effectively: 1. Collaboration scripts; and 2. Use of digital tools. We will explain below *why* you can use both strategies and *how* you could use them.

Collaboration scripts. Using 'role assignment' during the process of collaborative learning is a type of 'script': *"Role assignment is a scripting technique that gives students particular guidance about how to engage in discussion to support their individual thinking and collective interactions"* (Dillenbourg, 1999; Strijbos et al., 2004; as cited in Wise & Chiu, 2014). According to literature, role assignment can contribute to various aspects: increased student engagement, a sense of community, and greater student satisfaction (e.g. De Wever, Keer, Schellens, & Valcke, 2010). First, you can assign roles to students to increase **social presence**, i.e. the feeling that students actually belong to a group. The social tutor (Cesareni et al., 2016; Cacciamani et al., 2019) is an example of a role that can increase the sense of community.

> **Example**. In the study by Cacciamani and colleagues (2019), the teacher randomly assigned students to (alternatingly) take on the role of social tutor to facilitate discussion on a particular topic throughout a five-week period. The aim was to deliver a concept map at the end of this period. The social tutor was instructed to encourage his or her peers to actively participate in both online and face-to-face activities and to ensure that no one fell off the radar. Within this study, groups with and without a social tutor were compared. The researchers concluded that the presence of a social tutor has a positive effect on student participation and feelings of membership and thus helps to counter a possible feeling of loneliness among students in online education.

In addition to increasing social presence, you can also use role assignment with the aim of increasing cognitive presence, i.e. by creating a higher quality of interaction between students and thus trying to enhance knowledge development. For example, in addition to the social tutor, Cesareni and colleagues (2016) and Cacciamani and colleagues (2019) describe roles that apply to the content and context of the assignments students are given. Such roles can, for example, focus on structuring students' content-related discussions.

> **Example**. Cesareni and colleagues (2016) described an experiment in which they included a synthesizer role, with the specific task of summarizing and effectively building upon ideas that were raised during discussions. They concluded that the use of such a role during online discussions helps to experience a shared responsibility in terms of knowledge sharing and development.

Several general aspects have emerged from our analysis of the literature that are important to consider when implementing roles:
1. Think carefully about the nature and types of roles. What do you want to achieve? And how is that related to the learning objectives of the course? See also Table 2. For example, Cacciamani and colleagues (2019) used a social tutor with the idea of increasing the sense of community, and

roles were also used that served to monitor and structure the discussions (synthesizer, sceptic) or to work towards the final product (concept mapper).

2. Decide whether you want to alternate the roles, in order to prevent that one student is the social tutor during the whole process of collaboration. Alternating roles prevents a hierarchical relationship in the group.

3. Make use of multiple roles (alternating them if necessary), again to avoid a hierarchical relationship within the group, as in the study by Cesareni and colleagues (using the roles of social tutor, synthesizer, map-responsible and skeptic, alternating them per module).

4. Ensure that you provide students with instruction to carry out their role: it depends on the complexity of the role to what extent this is necessary. For example, in the study conducted by Sansone and colleagues (2018), students were trained as 'e-tutors', where there was instruction and 'modelling' by a professional e-tutor, and also an online community where the e-tutors in training could ask their questions.

Table 2. Overview of different types of roles, with examples of learning outcomes, roles and the papers in which these roles are described.

Type of role	Learning outcomes	Possible roles	References
Summarizer	Promoting knowledge construction / building	Summarizer, wrapper, synthesizer, concept mapper, theoretician	Cacciamani et al; Cesareni et al; Gasevic et al ; Wise & Chiu
Critical	Stimulating reflectivity, critical thinking, perspective taking	Sceptic, critic, case analyst, source searcher	Cacciamani et al; Weinberger et al; Cesareni et al; Gasevic et al
Moderator	Structuring the teamwork (goal-directedness)	Peer moderator, tutor, peer e-tutor, moderator	Xie & Yu; Sansone et al;
Social	Building a (sense of) community	Social tutor	Cacciamani et al; Cesareni et al
Expert	Promoting knowledge constructon	Topic leader	Gasevic et al;

Digital tools. The second instructional strategy that has proven effective according to the literature studied is the use of digital tools during collaborative learning. As a teacher, you can use technology to increase cognitive presence and reduce transactional distance (the psychological and communicative distance experienced between students and teacher(s)).

In the literature included for this paper, we found a wide range of tools that you as teacher can use synchronously and asynchronously to facilitate online interaction between students (see Table 3). All digital tools listed in the table focus on facilitating the synchronous and asynchronous interaction among students and play a crucial role in knowledge development (e.g. higher-order thinking, critical thinking). An example of a tool for facilitating synchronous discussions is explained below.

Tabel 3. Overview of digital tools, what they are used for, and in which papers the tools are described.

Digital tool[1]	Used for…	Reference
Discussion forums	Promoting discussions, asking questions, sharing of ideas and experiences – eventually contributing to knowledge building in online university courses	Linjawi et al ; Kumi-Yeboah
Graphic organizer	By spatially displaying relationships, they enable more efficient information processing/learning and stimulate metacognitive strategies in complex problem solving tasks	Kwon et al

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[1] Most of these digital tools are implemented within a broader learning platform such as Moodle and as part of online discussions (i.e. as a tool to facilitate interaction)

Knowledge maps	Enabling knowledge building and convergence (thus, critical thinking) by organizing and representing a group's knowledge structure (e.g. on instructional technology theory)	Draper
Wikis	Projects where students need to gather documents and peer editing is essential, i.e. collaboratively shaping content (e.g. for e-portfolio's)	Kumi-Yeboah
Digital whiteboards	Supporting synchronous discussions and facilitate knowledge construction (on e.g. the topic of gendered representation)	Sobko et al
Lecture capture	Decreasing transactional distance, supporting dialogue between teacher and students	Ekwunife et al

> **Example**. Sobko and colleagues (2020) used a whiteboard tool to facilitate synchronous interaction between students. Each week, students discussed the material they had read in break-out rooms. To facilitate discussion, guiding questions and a whiteboard tool based on a canvas online learning environment were used. At the beginning of the semester, students received explanation of the tool and were allowed to practice with it to familiarize themselves with the possibilities. The researchers focused on how students collaboratively analyzed two advertisements of the brand 'Play-Doh' and the way in which gender was expressed in them. Visualizing and representing their ideas on the digital whiteboard helped students to achieve a shift in their thinking about gendered representations.

Facilitating interaction

Teachers can facilitate interaction during the course by focusing on an appropriate teaching presence. In this context, it is important to note that social presence is a precondition for creating an effective learning experience and that, as a teacher, you must first focus on creating a safe learning environment (fostering social presence) before focusing on increasing cognitive presence (e.g. Garrison, Cleveland-Innes, & Fung, 2010).

This means that, at the beginning of the course, the teacher ideally should use strategies that are effective for building community and increasing student engagement. During the first meeting, the teacher could start with sharing information and setting clear rules and expectations about the course and the collaboration in groups. Secondly, at the start of the course, the teacher models the behavior he or she wants to see in students during community building. For example, taking an active role, stimulating students to show interest in each other, regularly posting comments online, and responding to what students contribute by asking follow-up questions, thus eliciting more interaction. To facilitate this process, you can also implement peer (e-)tutoring, for example by training some students to facilitate the collaborative process (see for example Sansone and colleagues, 2018 and the example on p. 10 on the social tutor).

Throughout the course, when the collaborative process is ongoing, the teacher can take on a more passive role and focus on modelling the process of collaborative learning. In this phase, it is especially important to ask open questions (see box below) that connect to the students' thinking process and stimulate their self-regulation. To do this properly, it helps to be online regularly and to monitor contributions (e.g. forum posts) by students, so that the teacher has an idea of where students are in their learning and thinking process. At the same time, research shows that teachers in higher education find it difficult to diagnose where their students are in their learning (Agricola et al. 2018). Asking questions can help.

Tip: Together with fellow teachers, think about what questions you could ask at which stages of the collaboration process in order to facilitate the learning and thinking process of students.

Sample questions: increasing student engagement
"How can you help each other? What do you need from each other?"
"What expectations do you have of each other? Discuss this among yourselves."
"To what extent is the procedure clear? Are there still questions?"
"What are you good at? How can you contribute to the group process?"
"What topics do you all find interesting? Where do you find each other?"
Sample questions: monitoring the learning process
"What have you tried? Where could you find an answer?"
"What made you come to this result?"
"What steps have you taken so far?"
"Please share your ideas on question X or topic Y."
"What does it mean when you put this finding in context Y?"

Conclusion

Our research question was: "*What strategies can teachers [in higher education] use to facilitate online interaction for collaborative learning*?" We can conclude that the majority (70%) of strategies found are 'instructional strategies', such as using scripts and digital tools to facilitate interaction. These are choices that an teacher makes during the design phase of a course. In the light of the scientific research included in this literature study, in which asynchronous communication (for example via discussion forums) predominated, these results are explainable. To facilitate asynchronous communication, the teacher must think carefully about structuring learning activities and instructions prior to the course.

It also became clear that the strategies used by the teacher change during the process of collaborative learning: at the beginning of a course, he or she takes a prominent role in organizing and directing interaction, focusing on community building (social presence), and later on the teacher is less active in the organization and more focused on the students' learning (cognitive presence). As a teacher, it is important to be aware of this. It helps to think about the questions you might ask students to facilitate their collaborative process at different stages of the course.

In conclusion, the evidence discussed in this review mainly directs to implementing strategies to *develop* a certain teaching presence (designing and organizing teaching) and not so much for *maintaining* teaching presence (direct instruction, scaffolding learning). The current results are primarily based on scientific research into asynchronous online learning. However, driven by the continuing corona-pandemic and all the possibilities online teaching offers, synchronous forms of collaboration are implemented more frequently to facilitate online collaborative learning in higher education. For example, currently a lot of teachers use Microsoft Teams, Blackboard classroom and, increasingly, Virtual Worlds. Our findings also provide numerous starting points for this synchronous online teaching practice (see recommendations below). For both synchronous and asynchronous forms of collaboration, the teacher must clarify expectations: what can students expect from collaboration? What are "the rules of the game"? What are the learning objectives? You also need to think about the 'how' of both forms: How can you, as a teacher, facilitate and support the interaction, both prior to and during the learning activity? How can you actively involve students? What digital tools do you use for this? Is instruction and practice necessary? However, synchronous online learning activities may also require other and/or additional strategies to develop and maintain teaching presence. More research into the role of teachers during synchronous online collaborative learning is therefore necessary.

Recommendations for (a)synchronous online education at Utrecht University

- Within faculties, we recommend stimulating evidence-informed educational innovation in the field of online education by, for example, facilitating teachers to conduct *Scholarship of Teaching and Learning* (SoTL) type research projects on how to best support synchronous forms of online collaborative learning, see the link to the Utrecht Roadmap for SoTL: https://www.uu.nl/onderwijs/centre-for-academic-teaching-0/educational-scholarship/scholarship-of-teaching-and-learning/utrecht-roadmap-for-scholarship-of-teaching-and-learning.

- It is important to carefully think in advance about how you want online collaborative learning to take place and how to best support this. During asynchronous collaboration, students often engage in long online discussions around a particular topic (e.g. threads lasting from one to six weeks). In those situations, role taking can help students structure the collaborative process to achieve a higher quality of interaction and 'cognitive engagement'. Although in this review role taking was primarily described in the context of asynchronous interactions, it can also be very helpful for facilitating synchronous interactions between students. It helps to make explicit what type of contributions is expected from whom (e.g. how to listen to and give feedback to each other's presentations; Gasevic et al., 2015).This encourages active participation and allows students to properly prepare their contribution. Another form of role assignment that could fit well with synchronous interaction is reciprocal peer tutoring, a form of peer assisted learning that is well suited for students from diverse disciplinary backgrounds. The idea is that students learn from and with each other and constantly alternate between the roles of tutor and tutee.
- The extent to which teachers should pay attention to community building is obviously very context dependent. In a course where students from only one program participate and almost everyone knows one another, this is less important than, for example, in a multidisciplinary and/or international (COIL) course where people meet for the first time at the start of the course. Therefore, it is important to already have a good idea of the expected student population during the design phase of the course.
- For an up-to-date overview of the digital tools that can be used in your education, go to the Educate-it website: https://educate-it.uu.nl/en/tool-guide/ or contact one of the educational consultants (educate-it@uu.nl).
- In this study collaboration scripts and the use of digital tools emerged as instructional strategies a teacher designs before the start of a course module, whole course, or program in order to structure the collaborative learning and interaction (e.g. Draper, 2015). It is important to not implement these strategies blindly. It remains essential to work from the principles of *constructive alignment*: choose the form that suits your learning objectives, for example, if you want to use roles. So, take what you want to achieve (learning objectives) as starting point and think about what type of online learning activities and roles help students achieve these objectives. If you need support for this, please contact the educational consultants at *Onderwijsadvies & Training* (onderwijsadviesentraining@uu.nl) .

References

Agricola, B. T., Prins, F.J., Van der Schaaf, M.F. & Van Tartwijk, J. (2018). Teachers' Diagnosis of Students' Research Skills during the Mentoring of the Undergraduate Thesis. *Mentoring & Tutoring: Partnership in Learning*, 26, 5, pp. 542–562. doi:10.1080/13611267.2018.1561015.

Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University.* Berkshire: The society for Research into Higher Education and Open University Press.

Boeije, H.R., Van Wesel, F. & Alisic, E. (2011). Making a difference: towards a method for weighing the evidence in a qualitative synthesis. *Journal of Evaluation in Clinical Practice*, 17, 4, pp. 657-663. doi:10.1111/j.1365-2753.2011.01674.x

Cacciamani, S., Cesareni, D., Perrucci, V., Balboni, G. & Khanlari, A. (2019). Effects of a social tutor on participation, sense of community and learning in online university courses. *British Journal of Educational Technology*. 50, 4, pp. 1771–1784. doi:10.1111/bjet.12656

Cesareni, D., Cacciamani, S. & Fujita, N. (2015). Role taking and knowledge building in a blended university course. *International Journal of Computer-Supported Collaborative Learning*, 11, 1, pp. 9-39. DOI 10.1007/s11412-015-9224-0

Deci, E.L., & Ryan, R.M. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55, 1, pp. 68-78. DOI: 10.1037110003-066X.55.1.68

De Wever, B., Keer, H.V., Schellens, T. & Valcke, M. (2010). Roles as a structuring tool in online discussion groups: The differential impact of different roles on social knowledge construction. *Computers in Human Behavior*, 26, 4, pp. 516-523. DOI:10.1016/j.chb.2009.08.008

Dillenbourg, P. (1999). What do you mean by 'collaborative learning?' In P. Dillenbourg (Ed.), *Collaborative-learning: Cognitive and Computational Approaches* (pp.1–19). Oxford: Elsevier.

Draper, D.C. (2015) Collaborative Instructional Strategies to Enhance Knowledge Convergence, *American Journal of Distance Education*, 29, 2, pp. 109-125. DOI:10.1080/08923647.2015.1023610

Ekwunife-Orakwue, K.C.V. & Teng, T.L. (2014). The impact of transactional distance dialogic interactions on student learning outcomes in online and blended environments. *Computers & Education*, 78, pp. 414-427. doi.org/10.1016/j.compedu.2014.06.011

Garrison, D. R., Anderson, T. and Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education,* 2, 2-3, pp. 87–105.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking and computer conferencing: A model and tool to assess cognitive presence. *American Journal of Distance Education*, 15, 1, pp. 7-23.

Garrison, D.R., Cleveland-Innes, M. & Shing Fung, T. (2010). Exploring causal relationships among teaching, cognitive and social presence: Students perceptions of the community of inquiry framework. *Internet and Higher Education*, 13, 1-2, pp. 31–36. doi.org/10.1016/j.iheduc.2009.10.002

Gašević, Adesope, O., Joksimović, S. & Kovanović, V. (2015). Externally-facilitated regulation scaffolding and role assignment to develop cognitive presence in asynchronous online discussions. *Internet and Higher Education*, 24, pp. 53-65. dx.doi.org/10.1016/j.iheduc.2014.09.006

Johnson, D.W. & Johnson, R.T. (1999). Making cooperative learning work. *Theory into Practice*, vol. 38, 2, pp. 67-73. www.jstor.org/stable/1477225

Kreijns, C. (2020). *Online samenwerkend leren en social presence*. Oratie. Open Universiteit.

Kumi-Yeboah, A. (2018). Designing a Cross-Cultural Collaborative Online Learning Framework for Online Instructors. *Online Learning*, 22, 4, PP. 181-201. doi:10.24059/olj.v22i4.1520

Kwon, K., Shin, S. & Park, S.J. (2018). Effects of graphic organizers in online discussions: comparison between instructor-provided and studentgenerated. *Educational Technology Research and Development,* 66, pp. 1479–1503. doi.org/10.1007/s11423-018-9617-7

Linjawi, A.I., Walmsley, A.d. & Hill, K.B. (2012). Online discussion boards in dental education: potential and challenges. *European Journal of Dental Education*, 16, pp. e3-e9. doi:10.1111/j.1600-0579.2010.00662.x

Moher, D., Liberati, A., Tetzlaff, J. & Altman, D.G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine*, 6, 7, pp. 1-6. doi:10.1371/journal.pmed1000097

Moore, M. (1997). Theory of transactional distance. In D. Keegan (Ed.), *Theoretical principles of distance education* (pp. 22–38). New York: Routledge.

Moore, M.G. (2013). The theory of transactional distance. In M.G. Moore (Ed.) *Handbook of distance education* (3rd ed., pp. 66-85). New York, NY: Routledge.

Redmond, P. & Lock, J.V. (2006). A flexible frame work for online collaborative learning. *Internet and Higher Education*, 9, pp. 267-276. doi:10.1016/j.iheduc.2006.08.003

Sansone, N., Ligorio, M.B. & Buglass, S. (2018). Peer e-Tutoring: Effects on students' participation and interaction style in online courses. *Innovations in Education and Teaching International*, 55, pp. 13-22. DOI:10.1080/14703297.2016.1190296

Sobko, S., Unadkat, D., Adams, J. & Hull, G. (2020). Learning through collaboration: A networked approach to online pedagogy. *E-Learning and Digital Media*, Vol. 17(1), pp. 36–55. DOI:10.1177/2042753019882562

Sobko, S., Unadkat, D., Adams, J. & Hull, G. (2019). Learning through collaboration: A networked approach to online pedagogy. *E-Learning and Digital Media*, 17, 1, pp. 36–55. DOI:10.1177/2042753019882562

Strijbos, J. W., Martens, R., Jochems, W. M. G., & Broers, N.J. (2004). The effect of functional roles on group efficiency: Using multilevel modeling and content analysis to investigate computer-supported collaboration in small groups. *Small Group Research*, 35, 2, pp. 195–229. DOI:10.1177/1046496403260843

Tinto, V. (1993). *Leaving College: Rethinking the Causes and Cures of Student Attrition* (2nd ed.). Chicago: University of Chicago Press.

Tinto, V. (1975). Dropout from Higher Education: A theoretical synthesisof recent research. *Review of Educational Research*, 45, 1, pp. 89-125. doi-org.proxy.library.uu.nl/10.2307/1170024

Van Leeuwen, A. & Jansen, J. (2019). A systematic review of teacher guidance during collaborative learning in primary and secondary education. *Educational Research Review*, 27, pp. 71-89. doi.org/10.1016/j.edurev.2019.02.001

Weinberger, A., Marttunen, M., Laurinen, L. & Stegmann, K. (2013). Inducing socio-cognitive conflict in Finnish and German 4 groups of online learners by CSCL script. *Computer-Supported Collaborative Learning*, 8, pp. 333-349. DOI:10.1007/s11412-013-9173-4

Wise, A.F., Hausknecht, S.N. & Zhao, Y. (2014). Attending to others' posts in asynchronous discussions: Learners' online "listening" and its relationship to speaking. *International Journal of Computer-Supported Collaborative Learning*, 9(2) pp. 185-209. doi.org/10.1007/s11412-014-9192-9

Wise, A.F. & Chiu, M.M. (2014). The impact of rotating summarizing roles in online discussions: Effects on learners' listening behaviors during and subsequent to role assignment. *Computers in Human Behavior*, 38, pp. 261–271. doi.org/10.1016/j.chb.2014.05.033

Xie, K., Yu, C. & Bradshaw, A.C. (2014). Impacts of role assignment and participation in asynchronous discussions in college-level online classes. *The Internet and Higher Education*, 20, pp. 10-19. doi.org/10.1016/j.iheduc.2013.09.003

Appendix 1: Detailed description of methods

- How did we arrive at the search terms?
  - For each element in the research question ("*What strategies can teachers [in higher education] use to facilitate online interaction for collaborative learning*?") alternative terms were searched in the thesaurus of the search engines and via subject headings.
    - Online: online courses, distance education, online education
    - Online interaction: computer-mediated communication, distance education, online learning, blended learning, distance learning, online discussion, asynchronous online discussion, online collaboration, online education, online learning environment, online environments, computer-assisted instruction, distance education and telelearning, online systems, "education, distance", massive open online course
    - Collaborative learning: collaboration, cooperative learning, Computer Supported Collaborative Learning, online collaborative learning
  - Logical constraints to the research question were devised:
    - Journal articles
    - Peer reviewed
    - English
    - From 2010/2011 until now (and next year)
    - Higher education
    - Restricting our search to STEM / science-education yielded too little results, so we decided to not set this limit.
- Which search engines did we use?
  - Psychinfo, ERIC and Scopus
- When did we perform the search?
  - Psychinfo and ERIC: November 3rd, 2020
  - Scopus: November 10th, 2020
- How many papers came out initially?
  - Psychinfo and ERIC: 380
  - We were not satisfied with the output and therefore also conducted a search in Scopus: 256 additional papers, so total of 3 search engines: 636 papers
  - Deleting duplicates resulted in a total of 584 unique papers
- What inclusion-criteria did we apply and how many papers did we retain?
  - Journal articles: N = 561
  - Higher education: N = 546
  - Western countries / English language. Western countries because of similar quality of internet facilities, similar setting/context regarding type of education (i.e. collaborative learning): N = 525
- How did we narrow down the set of papers?
  - By focusing on the role of the teacher in online collaborative learning. Remaining: N = 43
- How did we ensure we were left with a high quality set of papers?
  - By looking at content and method: N = 17
  - By searching for possible interesting additions in the references of those 17 papers: N = 19
  - By applying a quality check to this set of 19 papers (official quality appraisal check, Boeije): N = 17.
    - In first instance, checking the value was done on basis of title and abstract. The abstracts were checked to see if the paper actually focused on the question whether the interventions/what was researched actually worked to get students to collaborate.