

# Can an Instructor and Students Build Collaborative Partnership in an Online Course?

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**Abstract:** A collaborative partnership between the instructor and students has potential to transform education from the instructor-directed to student-centered learning. However, relevant inquiry indicated conceptual, practical, and methodological gaps on theory, practice, and research of the collaborative partnership. This study aims to better understand the collaborative partnership during actual teaching and learning processes. Using content analysis, we examined the instructor-student collaborative partnership from participation moves perspective in an online course. Results show that the instructor and students keep mutual interactions to construct knowledge; they maintain communications to design and implement online discussions; and they take joint actions to form a social, supportive learning environment. More importantly, a synergistic collaborative partnership was initially developed by the instructor and students. Based on the results, we provided implications to advance practices of the instructor-student collaborative partnership in online learning.

## Introduction

To prepare learners for the innovation-driven knowledge age, it is necessary to transform from a traditional, transmissive teacher-directed learning to a participatory, collaborative student-centered learning (Scardamalia & Bereiter, 2006). From a social and cultural perspective (Vygotsky, 1978), learning is not a passive process of reception, but, rather, a constructive process of knowledge (Damşa, 2014; Palincsar, 1998; Prawat, 1992). In traditional education structure, however, instructors possess a high-level control of design, instruction, and learning processes, e.g., identifying course content, designing and guiding learning activities, and making final evaluations (Cole, 1996; Palincsar, 1998; Wells & Arauz 2006). It is not easy for the instructor and student to build an effective collaborative partnership because it requires them abandon traditional transmissive-responsive roles in favor of more participatory, collaborative roles (Healey, Flint, & Harrington, 2014). In this study, we aimed to understand whether and how an instructor and students build a collaborative partnership in a graduate-level online course. Based on the results, we provided implications that were beneficial to foster the collaborative partnership between the instructor and students.

## Collaborative partnership

The concept of collaborative partnership is grounded upon social constructivism theory, which stresses the interconnected, interacting relationship between the social, cultural context and individual cognitive learning (Liu & Matthews 2005). In collaborative partnership, instructors need to relinquish some parts of their high-level control of instructional design, facilitation, and evaluation, and to form a more symmetrical, collaborative relationship with students (Cook-Sather, 2003). Students are encouraged to take responsibility for their own learning, become agentive constructors of their learning experiences, and facilitate authentic and purposeful interactions with others (Cook-Sather, 2003; Garrison, 1992; Healey et al., 2014). The subtle role shifts could result in a collaborative partnership between the instructor and students and transform the ways they understand teaching and learning (Cook-Sather, 2014a).

Educators have proposed several concepts, closely related to the instructor-student collaborative partnership, such as student voice (Cook-Sather, 2006; Fielding, 2004), students as partners (Healey et al., 2014), teachers as partners (Tabak & Baumgartner, 2004), and student-faculty partnerships (Cook-Sather, 2014a). The basic premise of student voice is that students have unique perspectives on learning and instruction, so that they could be afforded opportunities to actively shape their own learning and improve learning quality (Cook-Sather, 2006). To integrate student voice in educational practices, students work as partners (i.e., “students as partners”) with faculty, designers, researchers to design, discuss, reflect on learning, teaching, and assessment (Cook-Sather et al., 2014; Fielding, 2004; Matthews & Yanchar, 2018). Moreover, the “teachers as partners” concept is proposed to improve science learning quality, which suggests that a more symmetrical relationship between the instructor and students can help achieve a balance between teacher authority of knowledge and student meaning-making (Tabak & Baumgartner, 2004). The concepts of “students as partners” and “teachers as partners” imply the importance of student-instructor collaborative relationship for improving design, learning, and instruction.

Grounded upon these concepts, the concept of student-faculty partnerships supports transform teaching and learning from separated into shared responsibilities between instructors and students (Cook-Sather, 2014a). Although previous studies used varied interrelated terms leading to the concept of the instructor-student collaborative partnership, they did not make an explicit definition about collaborative partnership (Ouyang, Chang, Scharber, Jiao, & Huang, accepted). Therefore, there is a need to further understand collaborative partnership based on empirical research results.

The instructor-student collaborative partnership has been practiced in varied ways and to different extent during teaching and learning processes. For example, instructors engaged students as designers, facilitators, and evaluators to design and re-design learning activities (Barbera, Garcia, & Fuertes-Alpiste, 2017). A teacher engaged as co-participants with students in online discussions to together share and construct knowledge (Park et al., 2015). Students negotiated details of their research projects with instructors and actively engaged in research and inquiry (Healey & Jenkins, 2009). Empirical studies indicate that an effective collaborative relationship has potentials to advance varied aspects of teaching and learning, including knowledge construction and creation, curriculum design and pedagogy development, and scholarly investigations (Healey et al., 2014). However, it is not easy for the instructor and student to build an effective collaborative partnership because it requires them abandon traditional transmissive-responsive roles in favor of more participatory, collaborative roles (Healey et al., 2014). It is necessary to further investigate the actual collaborative partnership between the instructor and students during design, instruction, and learning processes.

## Methodology

### Research question

Our research question was: *Whether, to what extent, and how did an instructor and students build a collaborative partnership during online discussions?*

### Research context and dataset

The research context was a graduate-level online course entitled, *Online Learning Communities*, offered at a midwestern research university in the United States. The instructor (Danielle, pseudonym) of this course had 15 years of online teaching experience within higher education contexts. Twenty graduate students (16 females and 4 males) enrolled in this course during a 14-week semester of Spring 2014. Danielle hosted this online course through a social networking site Ning (see Figure 1). This course was primarily comprised of inquiry-based online asynchronous discussions, including instructor-designed and student-designed discussions. Data sources included all transcripts of class agendas, instructional videos/audios, discussions, weekly discussion summaries, as well as a class charter and final reflections.



Figure 1. The screenshots of the online course platform, hosted in Ning.

### Analysis strategies

We used content analysis method (Grbich, 2006) to analyze the collaborative partnership in terms of *participation move* between the instructor and students. Since this course was primarily comprised of inquiry-based discussions, we adapted the community of inquiry (CoI) framework (Garrison, Anderson, & Archer, 2000) as our analytical framework. To better fit the actual data, we slightly renamed some CoI codes or revised descriptions of the codes for this specific study (see Table 1). We used all CoI code categories to both the instructor and students. The unit

of analysis was paragraph in all transcripts. Four raters coded a subset (20% of the full dataset) individually first, and then had multiple meetings to resolve discrepancies, adjust the codes, and reach the agreement. Then, four raters used the adapted CoI framework to re-code the subset of dataset again. Krippendorff's (2004) alpha reliability was used to calculate inter-rater reliability among multiple raters. Krippendorff's alpha reliability were KEX: 0.76, KEL: 0.78, QER: 0.89, DO: 0.86, DF: 0.86, AS: 0.80, ES: 0.90, CP: 0.82, IC: 0.90. Given the strong reliability that ranged from 0.76 to 0.90, the first author independently coded the rest of the dataset.

Table 1: The adapted CoI coding framework

Dimension	Category	Description
Cognitive	Knowledge Exploration (KEX)	A participant explores information without elaborations
	Knowledge Elaboration (KEL)	A participant elaborates perspectives, with explanations, evidences, or personal experiences
	Question Elicitation & Response (QER)	A participant proposes questions, or responds to others' questions
	Design & Organization (DO)	A participant communicates goals, and designs activities
Teaching	Design & Organization (DO)	A participant communicates goals, and designs activities
	Discussion Facilitation (DF)	A participant initiates discussions, provides prompts, focuses the ongoing discussion on a specific topic
	Assistance & Summary (AS)	A participant offers assistance on issues related to activities, resources, or technologies, summarizes ideas and key topics
Social	Expression & Sharing (ES)	A participant expresses emotions, personal values, and attitudes, uses humor, shares things unrelated to course content
	Cohesiveness Promotion (CP)	A participant addresses others by names, addresses the group as "we", "us", or "our group"
	Interactive Communication (IC)	A participant continues a discussion thread, replies or comments directly to others

Then, we examined how cognitive, teaching, and social engagement moved back and forth between Danielle and students on a specific topic. *Participation move* was the turn-taking action between Danielle and students (e.g., Danielle -> students -> Danielle, or students -> Danielle -> students); one time of movement within each party was also accepted (e.g., Danielle -> Danielle -> students, or students -> students -> Danielle). Based on the previous analysis results, the first author individually identified strands of engagement moves and then asked other authors to double check the accuracy. Frequency of participation moves within strands ranged between 2 to 10. We decided to take a medium value of frequency - 5 times - as a threshold; all strands with engagement moves less than 5 were excluded.

## Results

We identified 13 strands of *participation moves* within the whole dataset; there were four types of strands: cognitive engagement moves - *idea building* (frequency=5), teaching engagement moves - *discussion design and implementation* (frequency=4), social engagement moves - *social learning environment building* (frequency=3), and an interweaving cognitive, teaching, and social engagement move - a "*design-inquiry-redesign-inquiry*" cycle, with *social supports* (frequency=1). We demonstrated one exemplar from each type of engagement moves to elucidate whether and how the instructor Danielle and students formed a collaborative partnership.

*Cognitive moves* Within five strands of cognitive engagement moves, Danielle and students took turns to build upon specific ideas. The cognitive idea-building process looked like this: the instructor Danielle first initiated a discussion on a topic by introducing relevant information through class agendas without explicit statements of her own ideas. Along with the introduction, she proposed some prompting questions to trigger cognitive inquiry. Then, in discussions, students presented their own ideas with detailed elaborations, supports of resources or personal experiences, and further extended, connected, and deepened others' ideas or perspectives. Danielle usually engaged in the discussion as well by pointing out a sub-topic, proposing relevant questions, or building upon students' perspectives. In addition, during discussions, students also proposed questions and provided answers, and sometimes made reflections. Finally, the cognitive engagement moves ended in Danielle's summary videos where she summarized students' thoughts, stated her own perspectives, and raised up collective knowledge (see Figure 2).

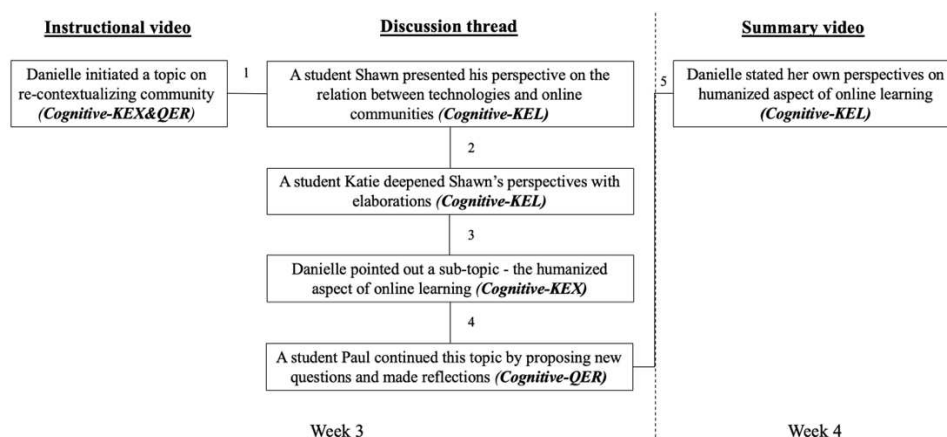


Figure 2. A cognitive move strand (frequency=5).

*Teaching moves* Within four strands of teaching engagement moves, Danielle and students took turns to design, organize, and implement weekly discussions as well as relevant resources and activities. The teaching discussion-design-implementation process looked like this: 3-5 students autonomously formed a student learning team to collectively design and facilitate a weekly discussion session. They collectively decided a discussion topic, selected resources and readings, as well as designed learning activities. One member initiated a class agenda document (usually through Google doc) for the team members to work on and also shared the document with Danielle. Based on the content in this document, Danielle provided some feedbacks and suggestions about the topic choice and relevant design. Then, based on her feedback, the student team continued to revise the design and organization of learning activities and resources. Danielle and students sustained communications until discussion design and organization were finalized and implemented. An exemplar showed how a student learning team and the instructor Danielle took turns to design, negotiate, and finalize discussion resources, activities, and posts in Week 10's topic Gamification (see Figure 3).

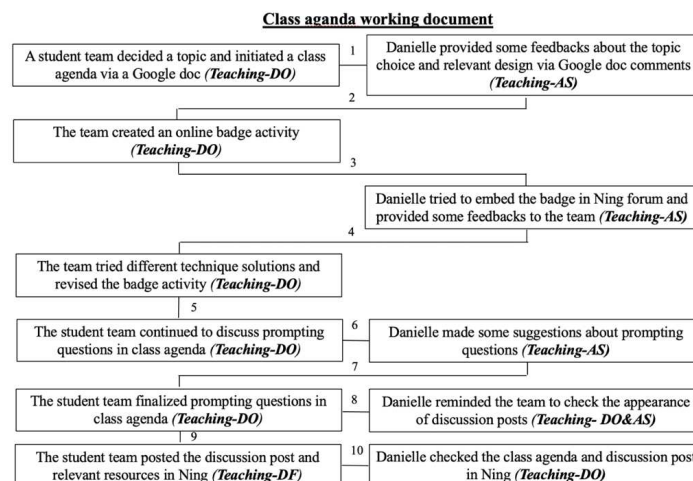


Figure 3. A teaching move strand (frequency=10).

*Social moves* In three strands of social engagement moves, Danielle and students took turns to contribute to the development process of a social, supportive online learning environment. The social process looked like this: Danielle and students first collectively created a class charter to build on guidelines of interaction, communication, and collaboration for this online course. Then students and Danielle acted accordingly in discussion processes in terms of the guidelines they created together. In other words, Danielle and students together contributed to social learning environment building process in terms of guidelines listed in the class charter. Finally, in the reflections, Danielle appreciated students for sticking with the guidelines they built together in order to build an online learning community; students acknowledged the effectiveness of co-creating class charter for building a social, supportive environment. An exemplar showed how Danielle and students took turns

to contribute to the social learning environment building process by sticking to one of the class guidelines - the importance of timing and formats of postings (see Figure 4).

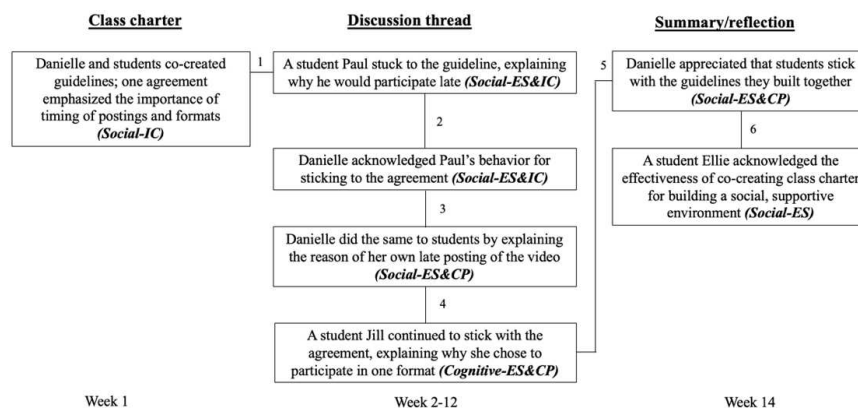


Figure 4. A social move strand (frequency=6).

*Interweaving moves* A strand of interweaving cognitive, teaching, and social engagement moves led to a more advanced, synergistic collaborative partnership between Danielle and students. During this process, Danielle and students completed one “design-inquiry-redesign-inquiry” discussion cycle, with social supports. Specifically, the facilitator adjusted a following week’s discussion topics, activities, and resources according to students’ emerging learning interests in order to foster deeper inquiry on the emerging topic. Social engagement was interweaved with most cognitive and teaching engagement, which served as a function to maintain interactive communications within the online community.

As we can see from the interweaving engagement exemplar (see Figure 5), Danielle mentioned the concept of “embodiment” in Week 2’s discussion, which was not the main topic (i.e., the concept of online learning community) for this weekly discussion (turn 2). Then, several students (e.g., Tracy) expressed their interests in learning more about this topic (turn 3). Taking students’ interest into consideration, Danielle in the next week’s class agenda included an optional article on “embodiment” for students to explore (turn 4). In other words, Danielle redesigned a part of the following week’s discussion topic to inspire students’ deep thinking and inquiry in this new topic. Students continued to share, construct, and build knowledge on the topic “embodiment” (turn 5). In addition, the social learning environment building process was interweaved with most cognitive and teaching engagement, which lubricated the conversations, helped build social bonds, and forged a community. Overall, this interweaving strand of cognitive, teaching, and social engagement demonstrated that Danielle and students moved toward a more joint, synergistic form of collaboration, through which they completed one “design-learning-redesign-inquiry” cycle together which was supported by a social learning environment building process.

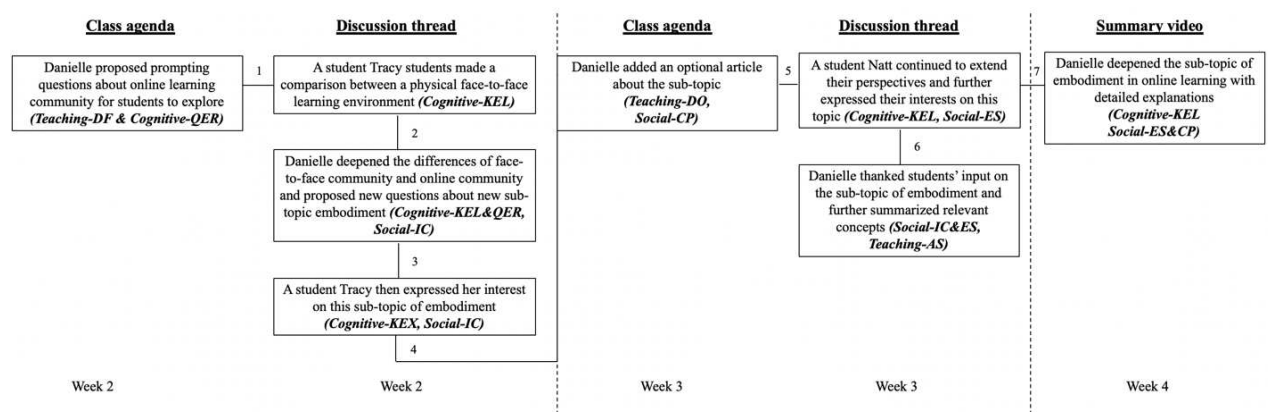


Figure 5. An interweaving move strand (frequency=7).

## Discussion

From the participation move perspective, Danielle and students took turns to contribute to cognitive, teaching, and social aspects in order to construct knowledge, design discussions, and build a social learning environment. Specifically, Danielle and students kept mutual interactions to share, construct, and reflect on knowledge together; they maintained communications to design, negotiate, and organize discussions; and they took joint actions to create class guidelines and acted accordingly to form a social, supportive learning environment. More importantly, an interweaving strand of their cognitive, teaching, and social engagement indicated that Danielle and students moved towards an advanced, synergistic form of collaborative partnership. Specifically, they negotiated, constructed, and completed one “design-learning-redesign-inquiry” cycle, supported with the building process of a social learning environment. This result indicated that Danielle and students started to form a higher-level, synergistic.

Building a collaborative partnership is a progressive process that requires joint engagement from both the instructor and students. As the research results showed above, the collaborative partnership was demonstrated in a way that a participant’s specific cognitive, teaching and social engagement influenced the subsequent actions of other participants, which had further influence on the next turn’s actions. Previous empirical studies also indicated the same pattern when the instructor and students attempted to build collaborations. For example, during science inquiry, students and their teacher, working as partners, took turns to construct meanings (e.g., Tabak & Baumgartner, 2004). An individual’s (i.e., the teacher or student) inquiry of a scientific question, idea, or phenomenon influenced the other one’s building-up process of the same question. In pedagogical development, students provided their instructor with information about their learning experiences with newly introduced pedagogical approach; the instructor then made pedagogical changes accordingly to further improve student learning experiences (Nel, 2017). Therefore, a collaborative partnership is conceptualized as a shared, negotiated work between students and their instructor to construct design, learning, and instruction processes together (Cook-Sather, 2014b; Crawford et al., 2015; Healey et al., 2014).

Overall, building the instructor-student collaborative partnership is a new, challenging educational practice. It is particularly challenging for instructors to create and maintain the connections with students in online higher education (Ouyang and Scharber 2017). Instructors are viewed as important agents of change in educational reform, such as building a collaborative partnership with students (Van der Heijden, Geldens, Beijaard, & Popeijus, 2015). Paradoxically, however, instructors are also viewed as major obstacles to change because of their adherence to outmoded approaches of instruction (Prawat, 1992). Building a collaborative partnership, particularly, requires the instructor abandon traditional, transmissive ways of knowledge delivery to use more negotiable, participatory, social approaches during design, instruction and learning (Cook-Sather et al., 2014; Evans, Muijs, & Tomlinson, 2015; Healey et al., 2014). This does not mean that instructors must co-design courses with students from scratch, given the overload work and time pressure (Blau & Shamir-Inbal, 2018). But, like Danielle did in this course, instructors can provide students with choices to negotiate learning processes and goals, and to take their own initiatives on learning design and facilitation. For example, instructors can give students rights to set dynamic learning goals based on their interests (e.g., Seale et al., 2015), to form and disband groups in terms of emergent goals (e.g., Zhang, Scardamalia, Reeve, & Messina, 2009), and to reflect on individual and group learning processes (e.g., Enyedy & Stevens, 2014). When students have a say about learning design and facilitation processes, view themselves as designers and creators of the learning process, and actually engage in the entire design, learning and instruction process, they may be more prone to take their own initiatives to improve teaching and learning (Evans et al., 2015; Matthews & Yanchar, 2018; Ouyang & Chang, 2019). In addition, as we can see that the interweaving collaborative turn-taking movement - leading to a more advanced form of collaboration - was facilitated with the use of social discourses, e.g., recognition, encouragement, and sharing of life stories. The results indicated that social discourses lubricated conversations (Park et al., 2015), built social bonds (Garrison et al., 2000), and created a trusting and supportive environment (Clarke & Bartholomew, 2014). Taken together, consistent with previous research’s suggestions (e.g., Nel, 2017), this study indicated that instructors need to make more deliberate efforts, such as using more negotiable, participatory, and social approaches, to design and facilitate a collaborative partnership as part of their pedagogies.

## Conclusions and future directions

In the current innovation-driven knowledge age, education is currently under a radical transition: the traditional teacher-directed, transmissive way of learning is challenged by a more active, participatory student-centered learning. This new model of learning requires authentic collaborations between instructors and students during course design, learning and inquiry, pedagogical development processes. As a community in the Learning Science field, researchers and educators consistently think about what learning is about and for, and who gets to decide. Echoing to this trend, this study aimed to advance practices of the collaborative partnership between the instructor and students. Although the research context itself focused on building an online learning community and caution



should be taken when interpreting and applying the results in different educational contexts, this study made critical contributions to better understand the collaborative partnership by empirically investigating this phenomenon in an online course, and offering theoretical and pedagogical implications. This study indicated that a collaborative partnership can connect student learning with instructional guidance, balance the tension between student active learning and teacher authorities, and facilitate a shift from the instructor-directed to student-centered learning. To better understand these questions, it is beneficial to foster collaboration between the instructor and students in different educational contexts, where they take initiatives and build ownerships for the design, instruction, and learning processes.

## References

- Barbera, E., Garcia, I., & Fuertes-Alpiste, M. (2017). A co-design process microanalysis: Stages and facilitators of an inquiry-based and technology-enhanced learning scenario. *International Review of Research in Open and Distributed Learning*, 18(6), 104-126.
- Blau, I., & Shamir-Inbal, T. (2018). Digital technologies for promoting “student voice” and co-creating learning experience in an academic course. *Instructional Science*, 46(2), 315-336.
- Clarke, L. W., & Bartholomew, A. (2014). Digging beneath the surface: Analyzing the complexity of instructors’ participation in asynchronous discussion. *Online Learning*, 18(3), 1-22.
- Cole, M. (1996). *Cultural psychology*. Cambridge, MA: Harvard University Press.
- Cook-Sather, A. (2003). Movements of mind: The matrix, metaphors, and re-imagining education. *Teachers College Record*, 105(6), 946-977.
- Cook-Sather, A. (2006). Sound, presence, and power: “Student voice” in educational research and reform. *Curriculum Inquiry*, 36(4), 359-390.
- Cook-Sather, A. (2014a). Student-faculty partnership in explorations of pedagogical practice: A threshold concept in academic development. *International Journal for Academic Development*, 19(3), 186-198.
- Cook-Sather, A. (2014b). Multiplying perspectives and improving practice: what can happen when undergraduate students collaborate with college faculty to explore teaching and learning. *Instructional Science*, 42(1), 31-46.
- Cook-Sather, A., Bovill, C., & Felten, P. (2014). *Engaging students as partners in learning and teaching: A guide for faculty*. San Francisco, CA: Jossey-Bass.
- Crawford, K., Horsley, R., Hagyard, A., & Derricot, D. (2015). *Pedagogies of partnership: What works?* York, UK: HE Academy.
- Damşa, C. I. (2014). The multi-layered nature of small-group learning: Productive interactions in object-oriented collaboration. *International Journal of Computer-Supported Collaborative Learning*, 9, 247-281.
- Enyedy, N., & Stevens, R. (2014). Analyzing collaboration. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences (2nd edition)* (pp. 191-212). New York, NY: Cambridge.
- Evans, C., Muijs, D., & Tomlinson, M. (2015). *Engaged student learning: High-impact strategies to enhance student achievement*. York, UK: Higher Education Academy.
- Fielding, M. (2004). Transformative approaches to student voice: Theoretical underpinnings, recalcitrant realities. *British Educational Research Journal*, 30, 295-311.
- Garrison, D. R. (1992). Critical thinking and self-directed learning in adult education: An analysis of responsibility and control issues. *Adult Education Quarterly*, 42(3), 136-148.
- Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, 2(2), 87-105.
- Grbich, C. (2006). *Qualitative data analysis: An introduction*. Thousand Oaks, CA: SAGE Publications.
- Healey, M., Flint, A., & Harrington, K. (2014). *Engagement through partnership: Students as partners in learning and teaching in higher education*. York, UK: Higher Education Academy.
- Healey, M., & Jenkins, A. (2009). *Developing undergraduate research and inquiry*. York, UK: Higher Education Academy.
- Krippendorff, K. (2004). Reliability in content analysis: Some common misconceptions and recommendations. *Human Communication Research*, 30, 411-433.
- Liu, C. H., & Matthews, R. (2005). Vygotsky’s philosophy: Constructivism and its criticisms examined. *International Education Journal*, 6(3), 386-399.
- Matthews, M. T. & Yanchar, S. C. (2018). Instructional designers’ perspectives on learners’ responsibility for learning. *Journal of Computing in Higher Education*, 30, 111-124.
- Nel, L. (2017). Students as collaborators in creating meaningful learning experiences in technology-enhanced classrooms: An engaged scholarship approach. *British Journal of Educational Technology*, 48(5), 1131-1142.

- Ouyang, F., & Chang, Y. H. (2019). The relationship between social participatory role and cognitive engagement level in online discussions. *British Journal of Educational Technology*, 50(3).
- Ouyang, F., Chang, Y. H., Scharber, C., Jiao, P., & Huang, T. (accepted). Examining the instructor-student collaborative partnership in an online learning community course. *Instructional Science*.
- Ouyang, F., & Scharber, C. (2017). The influences of an experienced instructor's discussion design and facilitation on an online learning community development: A social network analysis study. *The Internet and Higher Education*, 35, 33-47.
- Palincsar, A. S. (1998). Social constructivist perspectives on teaching and learning. *Annual Review of Psychology*, 49(1), 345-375.
- Park, J. H., Schallert, D. L., Sanders, A. J. Z., Williams, K. M., Seo, E., Yu, L. T., Vogler, J. S., Song, K., Williamson, Z. H., Knox, M. C. (2015). Does it matter if the teacher is there?: A teacher's contribution to emerging patterns of interactions in online classroom discussions. *Computers & Education*, 82, 315-328.
- Prawat, R. S. (1992). Teachers' beliefs about teaching and learning: A constructivist perspective. *American Journal of Education*, 100(3), 354-395.
- Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 97-118). New York, NY: Cambridge University Press.
- Seale, J., Gibson, S., Haynes, J., & Potter, A. (2015). Power and resistance: Reflections on the rhetoric and reality of using participatory methods to promote student voice and engagement in higher education. *Journal of Further and Higher Education*, 39(4), 534-552.
- Tabak, I. & Baumgartner, E. (2004). The teacher as partner: Exploring participant structures, symmetry, and identity work in scaffolding. *Cognition and Instruction*, 22(4), 393-429.
- Van der Heijden, H. R. M. A., Geldens, J. J. M., Beijaard, D., & Popeijus, H. L. (2015). Characteristics of teachers as change agents. *Teachers and Teaching*, 21(6), 681-699.
- Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Wells, G., & Arauz, R. M. (2006). Dialogue in the classroom. *Journal of the Learning Sciences*, 15(3), 379-428.
- Zhang, J., Scardamalia, M., Reeve, R., & Messina, R. (2009). Designs for collective cognitive responsibility in knowledge-building communities. *Journal of the Learning Sciences*, 18(1), 7-44.

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