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SPECIAL ISSUE ON COMPETENCY ORIENTATION IN PROBLEM-BASED LEARNING

An Expert Instructor's Use of Social Congruence, Cognitive Congruence, and Expertise in an Online Case-Based Instructional Design Course

Sunnie Lee Watson, Adrie A. Koehler, Peggy Ertmer, WooRi Kim, and Rudy Rico (Purdue University)

Abstract

Promoting and sustaining effective discussion—that which contributes to learning—is a skill that eludes many instructors (Darling-Hammond, 2008; Ge, Yamashiro, & Lee, 2000). This study explored the role and strategies of an expert instructor in an online advanced instructional design (ID) course that utilized a case-based learning (CBL) approach. Discussion posts, as well as interview data, were analyzed and coded to explore how the instructor utilized three strategies noted as being critical to students' learning during problem-centered discussions: social congruence, cognitive congruence, and content expertise (Schmidt & Moust, 1995; Yew & Yong, 2014). Results showed that facilitation choices were made with course goals in mind: modeling the case analysis process and improving students' ID problem solving. All three strategies were used frequently during discussion facilitation. Strategies tended to be implemented in clusters, with social congruence strategies appearing in every post but four. Implications are discussed for utilizing a combination of these facilitation strategies, in a dynamic manner, within a case-based context.

Keywords: case-based learning, social congruence, cognitive congruence, expertise, discussion facilitation

Introduction

Case-based learning (CBL) comprises "a narrative-based learning [approach] that has a rich tradition in professional education" (Heckman & Annabi, 2006, p. 141). Based on student- and problem-centered pedagogies, CBL engages students in authentic problem situations, characterized by their ambiguity and openness to multiple interpretations. Given the complex nature of a case study, students typically work collaboratively to clarify individual interpretations and, subsequently, to come to consensus regarding proposed solutions (Ertmer & Koehler, 2014). Through these collaborative discussions, students develop deeper understandings of the presented case issues and their connections to discipline-based concepts.

As a problem-centered approach to teaching, CBL relies on class discussion as its primary strategy (Dabbagh, Jonassen, Yueh, & Sanouilous, 2000; Heckman & Annabi, 2006; Levin, 1995). As described by Andersen and Schiano (2014), "The core of case teaching—and most of the art of it clies in managing the students' discussion" (p. 66). Wegerif and Mercer (1996) elaborated that successful interactions within problem-centered, collaborative forms of learning, including CBL, comprise a variety of "exploratory dialogue" among participants such as explaining, clarifying, challenging, and justifying.

Schmidt and Moust (1995) developed a robust framework for understanding key strategies used by effective facilitators of problem-centered pedagogies, including the application of social congruence and cognitive congruence strategies as well as the thoughtful use of content or discipline expertise. Given the importance of discussion to effective CBL, their framework provides a practical guide for examining effective facilitation in case-based discussions (Yew & Yong, 2014). In this study, we used this framework to examine how an expert CBL instructor applied these strategies to facilitate effective online case discussions. More specifically, we examined, in detail, the facilitation choices of an expert CBL instructor,

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with a focus on how she integrated the various strategies in order to encourage and maximize student learning within an online case-based course.

Literature Review

Case-Based Learning

CBL provides a means for educators to connect disciplinary content to real-world problems by prompting learners to consider situations they may encounter professionally (Stepich, Ertmer, & Lane, 2001; Ertmer & Stepich, 2002; Smith & Ragan, 2005). By analyzing the issues in a given case, students have the opportunity to develop an understanding of discipline-specific terminology and the various constraints typically encountered in practice (Dabbagh et al., 2000; Savery, 2006). As Jonassen and Hernandez-Serrano (2002) noted, "In professional contexts, people are expected to solve problems" (p. 67). Given its emphasis on engaging students in real-world problems, CBL has been found to promote a deep understanding of disciplinary content by allowing learners to discuss, reflect on, and propose solutions to complex problems (Capon & Kuhn, 2004; Chaplin, 2009; Yadav, Subedi, Lundeberg, & Bunting, 2011).

According to Hmelo-Silver (2013), each problem, or case, comprises an *afforded* problem space, which includes the specific knowledge, concepts, and features necessary for solving that case (Teasley & Roschelle, 1993). Based on this idea, the goal of CBL is for students to cover as much of the afforded problem space as possible (Ertmer & Koehler, 2014; 2015). Through peer collaboration and reflection, and the consideration of multiple perspectives, discussions have been shown to play a significant role in prompting learners to cover the problem space afforded by each case (Ertmer & Koehler, 2014; Flynn & Klein, 2001; Levin, 1995).

To support problem-space coverage during CBL, the instructor typically assumes the role of coach, guiding students to collaboratively identify problem elements within the case and to recommend viable solutions (Schmidt & Moust, 1995). According to Hmelo-Silver and Barrows (2006), the primary role of a facilitator is to create affordances for productive discourse. In an online case-based discussion, as with other facilitated online discussions, this includes developing the prompts to initiate discussion (Ertmer & Stepich, 2002; Kanuka, 2011; Wegerif & Mercer, 1996), using probing questions to maintain student focus and provide clarification (Carder, Willingham, & Bibb, 2001; Chng, Yew, & Schmidt, 2011), and bringing closure to the case discussion (Ertmer & Stepich, 2002; Rico & Ertmer, 2015).

Effective CBL Facilitation

Berliner (2001) noted that expert clinical teachers (i.e., those who regularly teach and assess case-based learning) have a shared understanding of how to solve a case, as well as how to teach and assess students' analyses of these cases. Other researchers (e.g., Shulman, 1986) have referred to this understanding as pedagogical content knowledge, or expertise. Schmidt and Moust (1995) built on this concept to propose and validate a causal model of an effective facilitator that included three primary characteristics: use of expertise and the application of social congruence and cognitive congruence strategies. As described by the authors: "Effective facilitators have a suitable knowledge base regarding the topic under study, a willingness to become involved with students in an authentic way, and the skill to express oneself in a language understood by students" (Schmidt & Moust, 2000, p. 47). Recently, Yew and Yong (2014) applied this framework to examine students' perceptions of the characteristics of good and poor problem-based facilitators, and to identify specific strategies related to effective facilitation. Similar to Schmidt and Moust (1995), their results suggested that competent facilitators were adept at integrating two effective strategies in their discussion interactions—social congruence and cognitive congruence—along with content expertise. In this study, we adapted this framework to examine how an expert CBL instructor facilitated online case discussions and to detail the manner in which content expertise was used in conjunction with social congruence and cognitive congruence strategies. We discuss each of these characteristics in more detail next. (Note: Given the general expectation that a CBL instructor acts as a facilitator during case discussions [Rangan 1996; Savin-Baden, 2003], we use the words "instructor" and "facilitator" interchangeably in this paper.)

Content Expertise

Content expertise refers to the facilitator's relevant content, or subject matter, knowledge. In a CBL approach, this includes his or her understanding of the targeted problem space afforded by the specific case under discussion. Research has demonstrated a relationship between a facilitator's content expertise and student satisfaction (Davis, Nairn, Paine, Anderson, & Oh, 1992) and achievement (Davis et al., 1992; Schmidt, Van Der Arend, Moust, Kokx, and Boon, 1993), as well as instructor facilitation style (Gilkison, 2003; Groves, Régo, & O'Rourke, 2005). This is similar to what Bond, Smith, Baker, and Hattie (cited in Berliner, 2001) reported in their extensive comparison of expert and non-expert teachers: the greatest discriminator between these two groups was the expert teachers' abilities to create and provide deep

representations of the subject matter. Schmidt (1994) noted that subject matter expertise had a significant impact on student learning especially when learning resources provided insufficient scaffolding or when students had low levels of prior knowledge.

Recent research (Ertmer & Koehler, 2015;Gilkison, 2003) has delineated a variety of ways in which content expertise is expressed within an online discussion, including summarizing, prompting, or refocusing students; evaluating or providing formative or summative feedback; and clarifying content and using direct questions to prompt deeper understanding of the content being discussed. In addition, Lewandowski, van Barneveld, and Ertmer (2016) noted that content expertise is demonstrated when the facilitator prompts students to consider connections to models or theories, and explicitly draws their attention to discipline-specific concepts and terminology. In this research, we looked for specific instances of these types of representations of a facilitator's expertise.

Social Congruence

In addition to content expertise, the use of social congruence strategies has been identified as an important facilitator attribute (Yew & Yong, 2014). Social congruence refers to a facilitator's "interpersonal qualities, such as the ability to communicate informally and empathically with students, and hence being able to create a learning environment that encourages an open exchange of ideas" (Yew & Yong, 2014, p. 796). Research suggests that effective social congruence allows a facilitator to anticipate student needs and reframe learning if necessary (Lockspeiser, O'Sullivan, Teherani & Muller, 2008). At the same time, facilitators' uses of social congruence strategies to create open, comfortable learning environments when implementing problem-centered methods can be a major determinant of student learning (Chng, Yew, & Schmidt, 2011). A survey by Otani, Kim & Cho (2012) affirmed the importance of social congruence from a student perspective, as participants indicated that a "positive learning environment" was one of the most influential aspects of an instructor's effectiveness. Similarly, Ge, Yamashiro, & Lee (2000) cited several studies that demonstrated that students' affective experiences are correlated with their cognitive achievement in online environments.

Research by Kassab, Al-Shboul, Abu-Hijleh, and Hamdy (2006), Kaufman and Holmes (1996), and Papinczak (2010) confirms the importance of social congruence to effective facilitation: medical students in problem-based learning contexts expected their instructors to not only be effective discussion facilitators, but also to be able to establish good student–teacher rapport and relationships by using strong interpersonal skills such as being respectful of students' opinions and being friendly and approachable. Similarly, Chng et al. (2011) found that the use of social congruence strategies had a significant impact on students' learning processes as well as final learning outcomes.

Within an online discussion, social congruence may manifest itself through the use of affective (such as sharing emotions), cohesive (such as greeting students or using student names), or interactive (such as acknowledging or approving student ideas) strategies (Richardson et al., 2015). These strategies, then, provided a starting point for our examination of the types of social congruence strategies used by the CBL facilitator in the online case discussions.

Cognitive Congruence

Finally, an instructor's ability to apply cognitive congruence strategies has been identified as an important aspect of facilitating problem-centered learning (Yew & Yong, 2014). Cognitive congruence refers to the facilitator's ability to present content to students in terms with which they are familiar (Schmidt & Moust, 1995). Lockspeiser et al. (2008) noted that students valued the cognitive congruence of tutors in an undergraduate medical program.

According to Schmidt and Moust (1995), cognitive congruence is essential as it allows a facilitator to recognize subtle difficulties students encounter while working through subject matter content. Shulman (1986) conceptualized this as pedagogical content knowledge, that is, knowing how to present complex content at an appropriate level for the given audience. Research suggests that facilitators who lack cognitive congruence also lack strategies to scaffold students' learning and do not understand learning needs (Yew & Yong, 2014). Cognitive congruence is considered important to student engagement and can have a significant impact on students' situational interest (Rotgans & Schmidt, 2011).

When discussions occur in an online environment, cognitive congruence strategies tend to be expressed when a facilitator emphasizes key points that may have been overlooked by students, or directs students' attention to an important idea shared by another student. In addition, facilitators can make concepts more relevant to students by providing multiple examples, illustrating where students may have encountered the concepts before, or sharing additional resources (Richardson et al., 2015). In this research, our examination of the cognitive congruence strategies used by the CBL facilitator began with a search for evidence of the application of these types of strategies.

Study Purpose and Research Questions

Studies have shown that facilitation strategies play an important role in helping students meet the goals of CBL, including covering the afforded problem space (Ertmer & Koehler, 2014; Hmelo-Silver & Barrows, 2006). Although the importance of

various facilitation strategies has been established (Mitchem et al., 2008; Schmidt & Moust, 1995; Yew & Yong, 2014), little is known about how and why an expert facilitator chooses and applies these strategies during the discussion process. Previous studies have looked primarily at students' perceptions of an expert facilitator and their preferred instructional approaches (Schmidt & Moust, 1995; Rotgans & Schmidt, 2011; Yew & Yong, 2014), but have not examined the instructor's choices or intentions behind their facilitation strategies. This study was designed to examine the choices of an expert CBL instructor in order to gain insights and a foundation for future research on improving CBL instruction and discussion facilitation within online learning environments. More specifically, we examined how an expert CBL instructor integrated her content expertise with social congruence and cognitive congruence strategies to facilitate students' coverage of the problem space in an online case-based course. We explored the following research questions:

1. How and why does an expert CBL instructor use social congruence to facilitate discussions in an online CBL course?
2. How and why does an expert CBL instructor use cognitive congruence to facilitate discussions in an online CBL course?
3. How and why does an expert CBL instructor use content expertise to facilitate discussions in an online CBL course?
4. How does an expert CBL instructor integrate the use of social congruence, cognitive congruence, and content expertise to facilitate discussions in an online CBL course?

Methods

Research Design

To answer our research questions, we used an interpretive, qualitative approach, with a focus on content analysis. Qualitative data in the form of the instructor's discussion posts were examined as the primary data source. In addition, a set of retrospective interviews, with the instructor, were used to consider how she prepared for case discussions and to triangulate findings. Through the analysis and integration of findings from both data sources, we were able to construct an understanding of both *how* an expert facilitator utilized social congruence, cognitive congruence, and expertise strategies in a case discussion as well as *why* she chose to use these strategies.

Description of Participants

Participants included an expert CBL instructor and ten students enrolled in an online graduate course, Advanced Practices in Learning Systems Design. Students were all graduate students working towards a master's degree in curriculum and instruction with a concentration in learning design and technology (LDT). The instructor, Anne, was a full professor in the College of Education. She had nearly 20 years of experience teaching online and approximately 23 years of experience using a case-based approach, in both face-to-face and online environments. Anne designed and taught the course, including facilitating the weekly online discussions. During the first three weeks of the course, she played a prominent role in the discussions, encouraging active participation and modeling the case analysis and discussion process. Following this, student teams were responsible for facilitating an assigned case: structuring and implementing a stimulating discussion about the issues in the case and providing a synthesis of the case discussion at the end of the week. Participants in the course were working professionals: six from business, three in K-12 education, and one in higher education. Five of the students were male and five were female. Before engaging in the study, Institution Review Board (IRB) approval was granted. The research team began by approaching the instructor and asking her to participate in the study.

Description of the Research Context

The course, Advanced Practices in Learning Systems Design, was an eight-week online course implemented in fall 2014 as part of an online master's program at a large Midwestern university. The course was designed to enhance the applied instructional design (ID) skills of learners via a case-based approach by engaging them in collaborative activities such as (1) analysis of ID case problems, (2) accessing a wide range of ideas and perspectives, (3) working with diverse individuals, (4) developing solutions to authentic ID problems via published case studies, and (5) giving and receiving constructive feedback. All coursework was completed online and revolved around two major activities: (1) the analysis and synthesis of ID case studies, and (2) students' ongoing reflection on the development of their ID expertise. Course activities were completed individually, in small groups, and through participation in whole class discussions throughout the term.

Before each week's case discussion, students were asked to read the assigned case and to complete a careful case analysis including identifying stakeholders, ID challenges, and potential solutions for the case. Case discussions took place in six of the eight weeks. Students participated in discussions by posting their own thoughts about the cases related to instructional design, commenting on others' ideas, and responding to questions about their own postings. The online discussions were designed to be a place to challenge, synthesize, apply, and evaluate the material in the cases as

well as the experiences, positions, and conceptions of others. Discussions ran from Monday to Friday, with students expected to participate throughout the week. Out of the total 100 points in the course, 28 points were based on discussion participation.

Data Collection

We collected all online discussion posts made by the instructor (n = 74) in the six case-based discussion forums. Out of the 628 total posts in the forums, the instructor's posts comprised 11.7%. No intervention, other than regular course activities, was provided. At the end of the fall semester, one three-hour retrospective interview was conducted with the instructor, with four follow-up interviews (less than 20 minutes each) completed early in the spring semester of 2015. In the interview, the researchers asked the instructor to review every post she made within the forum and retrospectively explain her thinking behind each post. The interview questions were semistructured, including questions such as "Can you walk us through your posts for the first instructor-led case?" and "What were you thinking when you wrote these comments and what were your intentions?" The LMS course site, materials, and syllabus were also reviewed by the researchers to gain a better understanding of the structure of the course. Triangulation was obtained by using multiple researchers and multiple data sources.

Data Analysis

Both inductive and deductive methods were used to develop the coding schema. First, codes were taken from previous literature related to effective facilitation of online discussions (Richardson et al., 2015). Guided by the definitions of expertise, social congruence, and cognitive congruence (Schmidt & Moust, 1995), additional codes were added that addressed these specific categories. For example, during the initial phase of our coding, we noted that the instructor often "tempered" her authority or expertise by using a positive tone and asking open-ended questions that prompted students to think more deeply about their initial ideas. That is, Anne rarely, if ever, criticized students' ideas, but rather used probing questions to prompt reflection on the feasibility of suggested solutions (See Table 4, comments 3 and 4). Given this pattern, we created a new code called "Tempering Expertise." Other emergent codes included directing student attention, connecting content ideas, and using direct questioning.

The research team coded and categorized the instructor's posts in order to identify her use of social congruence (e.g., showing care, being friendly and approachable, making informal comments, expressing appreciation for student efforts), cognitive congruence (e.g., providing summaries, repeating/acknowledging students' ideas, asking for clarification, evoking personal experiences, providing scaffolding), and expertise strategies (e.g., sharing new information, providing examples, elaborating ideas, explaining/clarifying difficult concepts). Data were analyzed using a constant comparison method (Glaser, 1965) to identify key themes related to strategies used by an online CBL instructor to engage students in the problem space afforded by each case study. Appendix A provides a complete list of codes and number of times each code was observed.

While posts were treated as qualitative data and interpreted by researchers in order to identify themes that directed the approach to answering the research questions, the total number of instructor posts and the total number of each type of facilitator strategy they represented were quantified. This was done in order to help the researchers reach a broach understanding of the amount of effort the instructor put into each facilitation strategy as well as the degree of instructor presence she implemented in the course. While numbers of posts do refer to quantity, ultimately, data analysis was driven by the qualitative nature of the data and quantities served only to supplement the researchers' data interpretation by providing a big picture of the breakdown of instructor posts by facilitation strategy in order to better answer the questions of how she used and integrated these strategies.

The interview transcript was then examined to gain a deeper understanding of the instructor's reasons for using these different strategies to engage students in the case discussion. First, all interview transcripts were reviewed in order to formulate initial codes and then divided into meaning units. The meaning units were then compared with the initial codes and structural analysis conducted to articulate meaningful themes, which were then cross-checked across data sources. We discussed the themes until researchers reached consensus (Creswell, 2014). Finally, member checking was applied to the data analysis results for feedback and approval.

Role of the Researchers

The research team included two faculty members and three doctoral students. The students had all previously completed the Advanced ID course, including one student who had cotaught the course twice with Anne. The two faculty members included the course instructor and an additional faculty member who had also taught the course. The instructor gave permission to examine the course discussion posts and also agreed to participate in a series of retrospective interviews about her discussion facilitation. The team met weekly to discuss ongoing data analysis methods and to come to consensus regarding analysis codes and emerging themes. The entire research team, including the instructor, engaged in the analysis of the discussion posts, thus providing researcher triangulation.

Results and Discussion

This study was designed to examine the facilitation choices made by an expert CBL instructor in order to gain insight toward improving discussion facilitation strategies within online CBL learning environments. More specifically, we examined how an expert CBL instructor used social congruence and cognitive congruence strategies and content expertise in her discussion postings. A set of retrospective interviews with the instructor helped us understand why she used the strategies that she did.

To begin, we examined the instructor's posts in the online discussion forums. Throughout the six case discussions, Anne made a total of 74 posts. On average, she posted 18 times/case in the instructor-facilitated case discussions and approximately 6 times/case in the student-facilitated case discussion. Analysis of these 74 posts resulted in a total of 631 indicators (Social Congruence = 319, Cognitive Congruence = 114, Expertise = 198).

Table 1. Number and percentage of social congruence, cognitive congruence, and expertise codes present in instructor's 74 discussion posts.

Total Number of Codes Tallied	*n* / % Social Congruence Codes	*n* / % Cognitive Congruence Codes	*n* / % Expertise Codes
631	319 / 50.5%	114 / 18.1%	198 / 31.4%

Across all discussion forums, the strategies most observed (in order from highest to lowest count) included acknowledging student ideas (n = 62), prompting students to consider additional topics or current topics more deeply (n = 53), inviting students to join and continue the discussion (n = 50), using students' names while conversing (n = 43), showing enthusiasm about discussion topics (n = 37), expressing approval of students' ideas (n = 35), emphasizing important ideas (n = 32), and direct questioning of student responses (n = 30). Table 2 shows the top 10 strategies evidenced within the instructor posts. Five of the top 10 codes related to social congruence indicators, 3 related to expertise, and 2 were cognitive congruence indicators.

Results are similar to those reported by Richardson et al. (2015) in a study of instructor presence in 12 online courses. Richardson et al. observed that instructors were fairly balanced (45–55% or 55–45%) in their use of social and teaching presence strategies. Social presence comprised participants' feelings of connection to each other and to the instructor (related to social congruence in this study), while teaching presence encompasses the instructor's design and organization of the course, facilitation of discourse, and directing of instruction—similar to cognitive congruence and expertise in this study. As noted above, 5 of the top 10 strategies used by the instructor in this study were related to social congruence while the other 5 related to expertise and cognitive congruence. The most observed strategy, "acknowledging student ideas" (n = 62), is similar to the "revoicing" strategy observed by O'Connor and Michaels (1992) and Hmelo-Silver and Barrows (2006), which they defined as clarifying and legitimizing an idea put forward by a student. Hmelo-Silver (2013) noted that this strategy can influence student discourse in a problem-centered discussion.

The retrospective interviews were designed to help us understand why the instructor chose to apply the specific strategies, listed above, during the case discussions. As such, we anticipated that Anne's responses would inform our understanding of

Table 2. Top 10 codes.

Code rank / name	Category	# Observations
1. Acknowledging student ideas	Social Congruence	62
2. Prompting students to consider additional topics or current topics more deeply	Expertise	53
3. Inviting students to join and continue the discussion	Social Congruence	50
4. Using students' names while conversing	Social Congruence	43
5. Showing enthusiasm about discussion topics	Social Congruence	37
6. Expressing approval of students' ideas	Social Congruence	35
7. Emphasizing important ideas	Cognitive Congruence	32
8. Direct questioning of student responses	Expertise	30
9. Tempering instructor expertise to promote a nonauthoritative environment	Expertise	28
10. Clarifies ideas or discussion	Cognitive Congruence	28

the case facilitation *implementation* process. However, during the interviews it became clear that the discussion facilitation process entailed much more than just what happened during the discussion itself. That is, the retrospective interviews augmented our understanding of how the instructor planned for, implemented, and reflected on the specific facilitation strategies she used. Given this emergent pattern, we organize the rest of our results into three main sections: Before, During, and After the discussion. These categories allow us to represent the entire facilitation process as perceived and attended to by the instructor.

Before Discussion

The instructor's choices of discussion structure and facilitation strategies were informed by her course vision and goals. That is, as Anne was planning the course and each discussion, she made strategic choices that impacted her and, ultimately, her students' engagement in the discussions. For example, when designing the course, Anne purposefully selected a variety of cases that represented different ID contexts and carefully structured each discussion so that problem space coverage would be maximized through the discussion questions and activities that she had planned. For instance, the three instructor-facilitated cases dealt with problem situations that occurred in corporate, K-12, and informal learning contexts, respectively.

> I really do try to pick those [case studies] carefully . . . So that they [students] can see some of the range in which designers will work and some of the range of issues and constraints that they'll deal with. There are different constraints in each of them too. In a very short period of time, we're trying to introduce them to what a designer's work looks like.

This effort in crafting the discussion structure and initial question prompts is not surprising, as research indicates that initial discussion prompts play an important role in activating prior knowledge (Schmidt, Loyens, Van Gog, & Paas, 2007) and in shaping the subsequent discourse (Ertmer & Stepich, 2002; Dolmans et al., 2002; Wegerif & Mercer, 1996).

Anne also discussed making a special effort to maintain a clear vision of the ID skills and behaviors she wanted to model for her students, so as to promote these skills within her learners. She specifically referred to modeling both ID expertise (how to think about the case) and the case facilitation process (how to facilitate and engage learners in a case discussion), while simultaneously engaging learners in a variety of activities as they participated in the case discussions: "If students are going to be using case studies themselves at some point, I want to model different ways you can do it." As a result, she designed a variety of different activities for the discussion forums that served as good examples of CBL engagement: asking students to role play, to debate issues, and/or to create visual prototypes. From her perspective, the discussion was key to learning from a CBL approach as it provided a medium for understanding:

> That's where the learning occurs in a case-based course, in my mind, it's through the discussion. So, the more ground you cover, the better the learning. It's this idea of problem space coverage. If you just talked about the design issue, you might miss talking about possible solutions, or the consequences of solutions.

In addition, Anne designed for efficiency when structuring discussions ("We've got a week to get through: who are the stakeholders, what are the issues, what are the solutions, what are the consequences of those solutions . . . So, that's a lot to get through."), requiring students to consider important aspects of the case, which in turn led to meaningful discussions:

> When students did the [Lynn Dixon] case, I said, "Draw a representation of the screen of the kiosk." They had to think like designers. They had to remember, "I've got old people; I've got young people . . . I've got English as a first language, English as a second language. . . ." [This activity] made them consider the [design] constraints while they were proposing a design.

She further explained the importance of structuring discussions in a variety of ways to generate active discussion:

> I structure the discussions in different ways. You're also thinking about: "Is this going to generate some good discussion? . . . Are there going to be different points of view?" Michael Bishop [the main stakeholder in the second case study] is set up as a debate—You have to generate discussion. If you just say, "What's the design issue?" you'll get some, but you won't get a lot [of discussion]. In general, there'll be a couple of disagreements, but then they'll come to agreement. And, that's it. So, you've got to think about—you can touch on the design issue, but then, how can you situate that so that there's enough conversation or differences of opinion so that you have some conversation.

These strategies, which addressed students' needs to master the required ID skills and knowledge, reflected Anne's use of pedagogical content knowledge in combination with effective facilitation strategies (Hashweh, 2005; Van Dreil & Berry, 2012). The decisions Anne made about the discussion structure and the strategies she put in place before the discussion started were based on her understanding of the cases and students' needs, which were drawn from her previous experiences teaching the course.

During Discussion

During the discussion, Anne provided prompts, scaffolds, questions, and hints for furthering the discussion based on

where it was in relationship to her goal of maximizing problem space coverage. For the majority of posts (49 of 75), she used a combination of facilitation strategies (i.e., social congruence, cognitive congruence, and expertise). For example, a typical post would use the student's name (social), repeat and acknowledge a student's idea (social), offer a summary (cognitive), and provide formative feedback (expertise). As one example, the following post, with associated codes, shows the various strategies used together:

> Gary (using student's name), I think you're right in assuming the budget wouldn't allow for that (acknowledging a student's idea; formative feedback)—so thinking of ways to individualize for local audiences, without adding a whole lot more content—or expense—(providing a summary) is critical.

Only four of Anne's posts did not include social congruence strategies. Of these four posts, three were initial discussion prompts, which were used to provide direction for the weekly discussion. In one instance, the instructor's post was entirely focused on social congruence, without addressing the other two areas. The remaining posts were either a combination of social congruence and cognitive congruence (n = 5) or social congruence and expertise (n = 16). Tables 2, 3, and 4 show the frequency for and examples of how Anne incorporated social congruence, cognitive congruence, and expertise strategies.

Social Congruence Strategies

As noted earlier, social congruence strategies were the most prominent strategy used by Anne. Specifically, repeat and acknowledgement (n = 62), invitation (n = 50), name and greeting (n = 43), and enthusiasm (n = 37) were the most prevalent. While use of some of the social congruence strategies are likely reflective of Anne's personality and personal style, many of the social cues were used intentionally to facilitate learning during the discussion. Anne shared that using names and greetings was an approach she commonly used when e-mailing someone or was similar to how she would communicate with someone in a face-to-face setting: "It's just the way that you would talk to them [students]."

At the same time, Anne shared that social tactics appeared useful for adding a positive element when providing constructive feedback and redirecting student's misconceptions: "You're having fun with this. But let's be more realistic." Anne noted that by acknowledging and repeating positive aspects of student posts, she could help students feel more comfortable presenting their own points of view: "[I'm] trying to do it in a way where it's like 'Let's think about this,' not attacking."

Finally, when appropriate, Anne disclosed previous experiences she had encountered to help students think of related possibilities. These types of social congruence behaviors are reflective of what McNeill and Pimentel (2010) referred to as "reflective discourse." Because Anne had a strong belief that it was important to prompt the negotiation of multiple meanings rather than suggesting one correct answer, she used social congruence strategies to smooth and facilitate the process. Anne's use of these strategies is supported by the results of studies by van Zee and Minstrell (1999) and McNeill and Pimentel (2010) who found that when teachers asked open-ended questions and responded to students in a neutral, nonevaluative way, they observed greater student participation and were able to elicit more student thinking and reflection during class discussions. Others (e.g., Ainley & Armatas, 2006) have also reported conditions that maximize interactivity through the use of "personalization techniques" (p. 384) tap into learners' initial motivational levels, thus increasing students' interest and engagement in the task.

Table 3. Frequency and examples of top 5 social congruence strategies.

Code rank / name	Example Verbatim Post	*n*
1. Acknowledging student ideas	Great design, Tony! I particularly appreciate how you designed the whole display around the theme of connectivity, which does seem central to what Ben and Laura wanted.	62
2. Inviting students to join and continue the discussion	Anne agrees: You gain a lot of goodwill (from legal) if you start with the existing course, so that makes a lot of sense. So what kinds of supplements might Craig add? (And this is a question for everyone, not just you).	50
3. Using students' names while conversing	Thanks to Gary and Annette for demonstrating this so clearly!	43
4. Showing enthusiasm about discussion topics	Anne notes: First of all, I love how you are supporting your decisions with evidence from the case—that's so important in the case analysis process. So BRAVO for that!	37
5. Expressing approval of students' ideas	Cool idea! Why not have a game night and get people to come and actually interact with the game?	35

Cognitive Congruence Strategies

The cognitive congruence strategies used most frequently included emphasis (n = 32), clarifying (n = 28), and directing student attention (n = 26). Based on our analysis of Anne's posts, cognitive congruence strategies were used most often to provide cues to students as to where to direct their focus, emphasizing important points that were made.

She would often clarify content when she sensed students' uncertainty or missteps and provide examples to help them move forward. Similarly, McNeill and Pimentel (2010) discussed how an effective teacher encouraged her students to consider multiple views and to reflect on their own and their peers' thinking by making explicit connections to previous comments made by students.

Anne's reflection on one thread echoes this idea and explains her use of cognitive congruence strategies:

> So, Greg responds, and I think it's a good response. That's why I've highlighted it. He's got a number of different strategies. Then Chad came back . . . trying to get around the issues of time. So there's a number of good responses . . . he's got some good points. So, I basically reinforce "you provide an alternative to test scores," which is good, and "you also consider the implications." So, I'm really just reinforcing that he's got some good ideas and he's thinking it through. I'm reinforcing [those ideas], but then I give an example . . . This situation reminds me of [an article in which] the researchers wanted to show a change in teachers' uses of technology and test scores. And they were looking at content tests, but basically what they showed was that students' writing improved. So [what I'm suggesting to the students is that] it [improvement] might be in a place that you're not looking. So I'm trying to give them another example without, again, giving all the ideas away.

Expertise Strategies

Anne also used a fair amount of expertise strategies in the discussion forums. The ones she used the most included prompting further discussion (n = 30), direct questioning (n = 30), tempering expertise (n = 28), connecting ideas (n = 27), and presenting an alternative viewpoint (n = 27). In her interview, Anne spent a lot of time discussing how and why she used these strategies for sharing expertise.

Specifically, she applied her expertise in CBL, discussion facilitation, and ID in a very strategic manner, resembling what Rangan (1996) described as *choreographing*: "Teaching by this method leads students through the key conceptual and decision issues in the case without necessarily prejudging the correctness of their students' contributions" (p. 2). As Anne explained during the retrospective interview,

Table 4. Frequency and examples of top 5 cognitive congruence strategies.

Code rank / name	Example Verbatim Post	*n*
1. Emphasizing important ideas	Anne [referring to herself in the third person] applauds: AH! So you DO think Michael had a good idea—and there's a silver lining somewhere in this dark cloud he's enveloped in right now. So tell us . . . what did he finally do to convince GameOn to buy his game?	32
2. Clarifies idea or discussion	On page 30 of the case it says that Michael began his conversation with the administrators saying, "Each game addresses specific grade level science concept standards . . ." So it must be there already, right?	28
3. Direct student attention	Have any of you taken a look at the Rigglefish game? (Go to www.velscience.com and request a guest password).	26
4. Provide example	This reminds me of some of the statistics I hear about the number of students who complete any given MOOC, compared to the number who enroll. The retention rate is dismal (around 5–7%), but if you're starting with 30,000 people, that's still a heckava lot more than you'd have completing most of our f2f classes! I think Paul's point is definitely worth considering.	10
5. Provide summary	At the end of this case, Michael is feeling pretty frustrated and is not sure how, or even if, he should continue to try to convince school personnel that they should adopt his games for their middle school science classes.	9

she often made tentative suggestions to her students: "You float these if/then statements, so 'if this, then that . . .' It just becomes a way of talking about it." In addition, she constantly prompted her students to think through case details themselves using what she described as "series of questions"—a method described in the literature as "reflective toss" (Hmelo-Silver & Barrows, 2006; Schoenfeld, 1998).

However, in considering how to provide support for her students, the instructor was quick to point out the importance of finding a balance between using questions that were too open and providing too much help: "What you have to find is a balance. I think that's what a lot of my posts are trying to do. I'm trying to find a balance, not trying to give them an answer." By tempering expertise, Anne felt that she

Table 5. Frequency and examples of top 5 expertise strategies.

Code rank / name	Example Verbatim Post	#
1. Prompting students to consider additional topics or current topics more deeply	Anne [referring to herself in the third person] nods: I know administrators really like to see cold, hard data. Where can Michael get these kinds of data?	53
2. Direct questioning of student responses	Would using a "paid" audience impact his results? How would his funder feel about it?	30
3. Tempering instructor expertise to achieve a non-authoritative environment	Jim—Correct me if I'm wrong but I thought that the CEO had stressed that there would be no increases in budget, resources, or time frame. Can Jack bring on a project manager without an increase in budget? Certainly this is an increase in personnel (read—resources). I just didn't think this was even an option. What do you think? This seems like a pretty slippery slope!	28
4. Connecting content ideas	Sophie, Tom, Jim and Ashley . . . let's just think about the scope of this—if the IM2M [Internet-based workshop] is really going to be available EVERYWHERE due to it being online—How many counselors are likely to be needed? Who pays them? Who trains them and how? F2F? Online? Do you see how quickly this could get out of hand? . . . I think Paul asks a great question—can the IM2M be successful without f2f interaction (or successful enough—however that is defined)? I'm not saying there'd be no interaction, but are there other options we haven't considered? Maybe this is something we should think about much more carefully. What do you all think?	27
5. Providing alternative viewpoint	Melissa [a stakeholder in the case] probably needs some reassurance that she will not be made irrelevant and that she has an important role in bringing this product to successful completion. With some careful attention to Melissa's concerns, perhaps Jack can change her from a gatekeeper into an ally. What do you think—is that a possibility?	27

was able to keep the discussion moving forward, without discouraging the students:

> Tempering your disagreement so that it still leaves the conversation open, particularly, in a case discussion, where multiple points of views are encouraged. But students are so intimidated at the beginning, so trying to get them over feeling intimidated and feeling comfortable is really important.

This approach is similar to that recommended in the scaffolding literature (e.g., Davis & Miyake, 2004; Ge et al., 2000; Saye & Brush, 2004). As noted by Reiser (2004): "[Scaffolding] entails a delicate negotiation between providing support and continuing to engage learners actively in the process" (p. 275). As observed in their analyses of expert tutors, Lepper, Wooverton, Mumme, and Gurtner (1993) noted that effective tutors adjusted their support to target what they considered to be an optimal level of difficulty. The tutors' goal was to find a balance between eliciting learners' active engagement with the problem and preventing frustration and "nonproductive floundering."

These studies suggest a role for guiding learning in complex problem-solving domains not only by structuring or simplifying the task but also by prompting learners to face some of the complexity in productive ways. As such, it's important that an instructor provide support in a way that doesn't oversimplify or decontextualize the authentic task students are asked to complete. The ultimate goal is to maintain an optimal level of challenge so that students stay engaged and continue to work collaboratively with their peers to resolve the issues presented in the case. In Anne's final announcement to the class, she expressed similar ideas to those that are recommended in the literature, referring to this balance between engagement and frustration as "optimal agitation." She explained to the students:

> The instructional goal of a course like this is that students will experience "optimal agitation"—because that's when you learn the most. As Rhonda noted, this is a good thing (even if it doesn't feel like it at the time)! David Jonassen, a giant in our field, noted that he loved to stir things up in the classroom and if students didn't leave frustrated after each class, he hadn't done his job. I'm not sure you always need to feel frustrated, but I think his comment that "learning is not a spectator sport" definitely applies to this course!

The instructor's expertise was apparent in her overall design of the case-based course and the specific case experiences she developed for her students. When conceptualizing a case discussion, Anne's intentions were: (1) to create a structure that was appropriate for the online setting and which enabled a rich and meaningful conversation to take place; (2) which could be efficiently and effectively completed during the planned discussion time period; and (3) which provided variety in structure. As discussion initiation techniques can be very impactful in setting the direction during CBL (Ertmer & Stepich, 2002), the extensive planning that Anne described enabled her to meet these goals.

In addition, the instructor recognized the limitations of her own expertise. When facilitating a new case, she brainstormed with co-instructors and found ways to supplement her own content expertise: "We just brainstormed a lot—what can we do, how can we set this up . . . But, what I think finally helped us focus [on this particular case study], I had a Skype call with the author of the case and let her talk to me more about the case. I think the things she pointed out as being important, we hadn't necessarily pinpointed."

Integration of Strategies

It was notable that the instructor's strategies were almost always implemented in certain groups or clusters. For example, the use of acknowledgment and approval strategies were almost always coupled with an invitation or prompt to consider a new idea or an alternative viewpoint, as illustrated in the following post:

> What I like about this idea, Tom, is the option for a short 5–7 minute overview, which might just be fine for the majority of visitors. Makes me wonder if we've been overthinking this—Maybe we don't need so many deep dives—maybe it's more important to reach MORE learners with this nice, powerful overview. Just wondering . . . sometimes the simplest solution is the best.

Emphasis, enthusiasm, and emotion prompts were also often used together, as seen in the fourth example of Table 4. Direct questioning strategies were mostly used at the end of a post to prompt student reflection. Connecting ideas, synthesis, and alternative viewpoint strategies were often grouped together as well, as illustrated by the fourth example in Table 5. These strategies were also often followed by the use of prompts and invitations to encourage reflection.

When Anne transitioned from facilitating the case discussions herself to supporting the student facilitators, the number of posts decreased. However, even though the number of posts was less, the instructor appeared to use the same strategies throughout the semester. Although she suggested that she dedicated a lot of effort during the first week to modeling how to "interact with each other" and "think about a case," she explained how the nature of her facilitation was mostly very adaptive and flexible and that she facilitated based on what was needed. "It really depends on what's being discussed and whether I feel the need to jump in to emphasize something, or

redirect." This is similar to what has been observed of experts in other fields. Berliner (2001) noted that experts are more flexible and "opportunistic" than novices, being able to quickly process and respond to the changing needs of learners. Berliner and Scardamalia (1993) referred to this characteristic as "adaptive" or "fluid" expertise—that is, the abilities that come into play when an expert confronts challenging or novel tasks.

After Discussion

Finally, after the discussion was over, Anne provided a summary of the discussion and expanded on discussion points that were covered by the students in the week's discussion. According to Anne, this was an opportunity to extend the covered problem space.

For example, in the first instructor-led discussion, Anne provided a detailed summary of the discussion, helping students explicate the case analysis process that they would be applying to future case studies. In addition, she encouraged them to individually think about other issues not addressed in the class discussion:

> One thing we didn't really talk about was *contractual issues*—this was one of Craig's big takeaways from this case. What might he have spelled out more clearly to make his life a little easier when this whole thing started to implode (or explode)?
>
> One final thing we only touched on lightly was the fact that the deliverable (a one-day workshop) was decided BEFORE Craig did his **training** needs analysis. How might Craig have handled this part of his assignment, before taking the job, which would have enabled him to avoid some of the problems he encountered later when he uncovered all the **non-training** needs? Lots of food for thought, right?

Prompting students' reflection on the case analysis process was another important aspect of this phase. Anne encouraged students to engage in a "Lessons Learned" wiki activity, where she asked them to share impactful takeaways from each case. The idea was to consider where and when in the discussion the students experienced "ah-ha" moments, or a specific lesson learned, that they would like to "tuck in their back pockets" to recall during future projects. While the lessons learned activity was not graded, nearly every student added two lessons each week, with takeaways ranging from reflections on the case analysis process itself to reflections on the case situation. For example, during the second week, one student discussed a key takeaway from case analysis process:

> We often think of instructional design challenges as centering on the question, "How will I think up a way to teach this material to students?" But it's important to remember that before you can even reach that point, you have to ask yourself how you will come by the knowledge yourself. Being able to work with SMEs is as much a skill as organizing and managing the information they give you.

Following the discussion, whole group activities were somewhat limited. However, at the end of the week and into the next week, Anne continued to prompt student reflection. As the class moved onto the next case discussion, she helped students to consider the bigger picture and to see the progress they were making from week to week. For example, at the end of a student-facilitated week, Anne posted comments that focused on the entirety of the learning process:

> The case discussion was really lively this week—lots of great suggestions for how to convert the f2f workshop into an effective online course. As Greg noted, there was a noticeable shift from thinking, "This could never work" to "I think we can make this work." This demonstrates the benefit of pulling all of our ideas together to come up with something better than any single person could have proposed on their own. This is why we engage in these discussions—to expand our thinking and to walk away with better ideas than we started. Hoorah!

Anne's emphasis on the postdiscussion reflections and summary, despite the short time period of the course, echoes the work of Salomon and Perkins (1989), who noted that reflection is critical in supporting the construction of wide-ranging and flexible knowledge. Researchers have observed that when instructors decrease the process of closure, students acquire less knowledge from the learning process (Gertzman & Kolodner, 1996; Hmelo, Holton, & Kolodner, 2000). Levin (1995) also noted that discussion appeared to act as an important catalyst for reflection for experienced teachers, helping them to learn through the writing or reading that was prompted through the reflection process. Collins and Brown (1988) highlighted the importance of reflection during reasoning activities. Finally, Kolodner, Hmelo, and Narayanan's (1996) work argued for the criticality of helping learners reflect on their case-based reasoning experiences so that they can effectively "reuse" these experiences later.

Implications

New online instructors often find asynchronous discussions and collaboration overwhelming and could benefit from knowing how and when to apply effective facilitation strategies (Garrison & Anderson, 2003). While mentoring online instructors is important (Redmond, 2011), the opportunity

to learn from expert instructors can help novice instructors become familiar with best practices for online discussions (Richardson & Alsup, 2015).

The primary implications of this study stem from the deeper understanding gained by observing what online discussion facilitation strategies look like in action, thus providing insight into the specifics of CBL facilitation and online facilitation, in general. More specifically, the activities the instructor engaged in before (designing), during (facilitating), and after (summarizing and expanding problem space) the case discussion exemplify how instructors can plan for, implement, and be present in online discussions without being too directive or authoritative. It also gives specific examples of how to encourage, support, challenge and stretch students' learning through the use of social and cognitive congruence strategies and through the intentional application of content expertise.

Finally, the instructor's awareness of students' progress during the weekly case analyses was evident through her adaptive use of the different strategies. For the case studies she had previously used in her courses, she could anticipate where students would struggle and knew how to question and challenge their thinking in order to maximize the problem space (Ertmer & Koehler, 2014). In contrast, for the cases she hadn't previously facilitated, she sought out expertise from others who were familiar with the case or context (e.g., case authors, ID practitioners). Anne was aware of her own facilitation limitations and sought ways to become more effective. This adaptability and flexibility, typical of ID experts (Ertmer & Stepich, 2005), was demonstrated by the dynamic manner in which the instructor used the various facilitative strategies, including strategic use of clusters/groups of strategies. Furthermore, based on her goals for the course, she maintained a continuous awareness of current problem space coverage, which impacted ongoing decisions regarding how to extend that coverage.

These findings provide insights into the type of discussion facilitation strategies an instructor utilizes in an online CBL context that may help improve instructional design and CBL instruction for student learning. As CBL continues to be recognized as an effective instructional method (Cam & Geban, 2011; Kaddoura, 2011; Yadav, Vinh, Shaver, Mechi, & Firebaugh, 2014), further understanding of instructional design and effective facilitative approaches can help ensure a high quality CBL learning experience.

Limitations and Future Research

There are several limitations to consider when interpreting the findings of the study. First, the study focused on one online class that consisted of one CBL expert instructor and ten graduate students. Additional courses would allow comparisons between online discussion facilitation strategies of different instructors and in different contexts to provide a clearer understanding of what strategies are most commonly used by effective CBL instructors. Furthermore, the study identified an expert instructor but did not seek to evaluate the efficacy of her practices and did not incorporate student perspectives of the course. Future research is needed to examine the relationship between instructor facilitation strategies and student learning as measured by both self-evaluations and the instructor's evaluation of students' performance in the course (e.g., individual analyses of the cases). The design of our next study includes a comparison between the facilitation strategies of multiple instructors and their students' perceptions of their facilitation strategies, using end-of-course surveys and follow-up interviews. Finally, it is important to note that the instructor of the course was a member of the research team. The remaining research team members were not participants in the course. Although the instructor's role was no different from her course facilitation in any of her other courses, and she was not aware of the fact that her discussion posts would be used for the study analyses, it is possible that the descriptive validity of the study could be impacted. Nevertheless, the goal of the study was to closely examine an expert online CBL instructor's facilitation approaches and understand the decisions she made in order to better support case-based discussions; any interview of an expert instructor would result in the same potential for bias from the interviewee.

With close to 7 million students currently taking at least one online course and the projected increase in online course offerings (Allen & Seaman, 2013), it is critical for educators to understand how an instructor's use of social and cognitive congruence strategies and content expertise can be used to facilitate student engagement in the course as well as how these strategies can help students address the intended topics/problem space. Especially when implementing student-centered approaches, such as problem-based learning (PBL) and case-based learning, providing support for educators is essential to ease the transition from a traditional lecturer to a learning facilitator (An, 2013; Lowenthal & Lowenthal, 2010). PBL and CBL not only require the facilitator to be a content expert but also to be socially congruent and to relate to students on a more personal level (Yew & Yong, 2014). In evaluating the strategies an expert instructor used in an online instructional design graduate course, the findings from this study can inform the creation of guidelines for best practices when implementing online discussions.

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Categories	Instructor Facilitated Case 1 Part 1	Instructor Facilitated Case 1 Part 2	Instructor Facilitated Case 2 Part 1	Instructor Facilitated Case 2 Part 2	Instructor Facilitated Case 3 Part 1	Instructor Facilitated Case 3 Part 2	Team Facilitated Case 1	Team Facilitated Case 2	Team Facilitated Case 3	TOTAL COUNTS BY INDICATOR
Social										
Affective										
Af-Self Disclosure	1		2	2		1	1	1	1	9
Af-Value						1			0	1
Af-Emotion	1	5	5		1	1	1	1	2	17
Af-Enthusiasm	3	6	6	2	2	6	2	7	3	37
Af-Humor	1	1	1	1			1	1	1	7
Af-Rich media									0	0
Cohesive										
Co-Greeting &Saluations	1	1	2	3	7	1	2	4	5	26
Co-Name	4	3	6	4	8	6	1	4	7	43
Co-Encourage	1				1	1	2	1	2	8
Co-Group Ref	1	3	1	1	1	1		1	3	12
Co-Collaborative									0	0
Co-Diversity									0	0
Interactive										
Ak-Repeat/ Acknowledgment	8	12	9	5	7	7	1	7	6	62
AG-Agreement/ Disagreement		3	3	1	1	2	1	1	0	12
AP-Approval	1	4	5	2	7	7	2	6	1	35
I-Invitation	4	12	10	5	4	1	3	4	7	50
TOTAL SOCIAL INDICATORS	26	50	50	26	39	35	17	38	38	319
Cognitive Congruence										
Facilitating Discourse										
FD-Emphasis	2	3	7	3	2	5	2	5	3	32

Categories	Instructor Facilitated Case 1 Part 1	Instructor Facilitated Case 1 Part 2	Instructor Facilitated Case 2 Part 1	Instructor Facilitated Case 2 Part 2	Instructor Facilitated Case 3 Part 1	Instructor Facilitated Case 3 Part 2	Team Facilitated Case 1	Team Facilitated Case 2	Team Facilitated Case 3	TOTAL COUNTS BY INDICATOR
FD-Direct StudentAttention	3	6	4	2	1	4	1	3	2	26
FD-tips	1		1	1		1	1		1	6
FD-summ		1	1	1	4	1		1	0	9
FD-TipsOutside			1						0	1
Direct Instruction										
DI-Clarify	4	2	5	3	2	2	2	3	5	28
DI-example			1	3	1			2	3	10
DI-Demo									0	0
DI-resource				1					1	2
TOTAL COGNITIVE INDICATORS	10	12	20	14	10	13	6	14	15	114
Expertise Indicators										
Facilitating Discourse										
FD-prompt	4	13	10	5	6	2	2	4	7	53
FD-Askfor Clarification			3	1	1				1	6
FD-Connects ContentIdeas		1	2	3	5	5	1	5	5	27
FD-AltViewPoint	2	2		3	4	2	2	3	9	27
Direct Instruction										
DI-Clarify							1	3	0	4
DI-example			1	3	1			2	3	10
DI-Demo									0	0
DI-resource				1					1	2
TOTAL COGNITIVE INDICATORS	10	12	20	14	10	13	6	14	15	114

Categories	Instructor Facilitated Case 1 Part 1	Instructor Facilitated Case 1 Part 2	Instructor Facilitated Case 2 Part 1	Instructor Facilitated Case 2 Part 2	Instructor Facilitated Case 3 Part 1	Instructor Facilitated Case 3 Part 2	Team Facilitated Case 1	Team Facilitated Case 2	Team Facilitated Case 3	TOTAL COUNTS BY INDICATOR
Expertise Indicators										
Facilitating Discourse										
FD-prompt	4	13	10	5	6	2	2	4	7	53
FD-Askfor Clarification			3	1	1				1	6
FD-Connects ContentIdeas		1	2	3	5	5	1	5	5	27
FD-AltViewPoint	2	2		3	4	2	2	3	9	27
Direct Instruction										
DI-Clarify							1	3	0	4
DI-DirectQuestion	4	7	5		6	2	1	4	1	30
Assessment									0	
As-Frmdsc	1		3		6	6	1	3	3	23
TempExpertise	1	7	9	2		1	2	1	5	28
TOTAL EXPERTISE INDICATORS	12	30	32	14	28	18	10	23	31	198
TOTAL INDICATORS BY FORUM	48	92	102	54	77	66	33	75	84	

Sunnie Lee Watson is Assistant Professor of Learning Design and Technology at Purdue University. She teaches and conducts scholarly work in the field of information age, learner-centered education. Her areas of research focus on attitude change instruction, information-age educational technology such as MOOCs and PIES, and critical systems theory for qualitative educational research and school change.

Adrie Koehler is a visiting assistant professor of Learning Design and Technology at Purdue University. Her professional interests include the consideration of instructional strategies in teaching and learning processes. Specifically, she has explored these topics through investigating in what ways emerging technologies can be used for instructional purposes; how instructors develop a presence in online settings and the impact of this presence; and methods to best facilitate case-based instruction. Additionally, she is interested in discovering techniques for improving the transition of preservice teachers into the education profession.

Peggy Ertmer professor emerita of Learning Design and Technology at Purdue University. Her scholarship focuses on the impact that student-centered instructional approaches and strategies have on learning. Activities that support this focus include research on the impact of case-based instruction on higher-order thinking skills; the effectiveness of a student-centered, problem-based learning approach to technology integration and STEM education; and strategies for facilitating higher-order thinking and self-regulated learning in online learning environments. Additional efforts are directed toward helping students become expert instructional designers through the use of case- and problem-based learning methods. In 2014, Professor Ertmer was recently flown to George Lucas' Skywalker Ranch to be interviewed in the latest video from his nonprofit organization, Edutopia. As the founding editor of the *Interdisciplinary Journal of PBL* (problem-based learning), she is a leading expert in this emerging field. In the video she outlines the five keys to problem-based learning: real-world connections, core to learning, structured collaboration, student driven, and multifaceted assessment.

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