

Communication in a web-based conferencing system: the quality of computer-mediated interactions

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Abstract

Time constraints and teaching in crowded classrooms restrict in-depth dialogical interaction in teaching and learning. Electronic conferencing systems, however, have the potential to foster online discussions beyond class time. Case-based instruction also constitutes a promising approach in fostering learners' participation and reflection. The purpose of this study was to investigate (a) the extent to which an electronic conferencing system, named COW ("Conferencing on the Web"), facilitates pre-service teachers' communication outside their classroom, when discussing teaching cases from their field experiences, and (b) the potential of COW and case-based instruction to foster quality discourse and promote students' critical-thinking skills. **The results showed that students' online discourse was mostly an exchange of personal experiences and did not reflect well-supported reasoning.** Future research on the issue of interactivity should address motivational and affective variables related to the implementation of distance-education methods, variations in pedagogical activity and task structure, and the readiness of mentors and learners.

Introduction

Social interaction is highly valued for developing, through mentoring, students' critical-thinking skills. Vygotsky (1962) asserts that dialogical interaction can take place in collaboration with other people in a social environment or within one's self in

the form of an internal dialogue, often called reflective thought. Likewise, Bruffee (1984) views dialogue as a necessary element in composing thoughts. In arguing that all knowledge is constructed, and that social interactions are crucial in the knowledge construction process, he reinforces the theoretical foundation for using dialogues and conversations among people to develop their critical-thinking skills.

Critical thinking has been defined in a number of different ways (Paul, 1995; Ennis, 1985), but, in this study, we accepted Paul's (1995) position that critical thinking refers to good quality thinking. He states that to think well, one must impose discipline and restraint on his or her thinking, and raise it to a level of "perfection" or quality that is not spontaneous thought. Therefore, a critical thinker does not simply assert a point of view, but attempts to reason things out based on well-supported judgments and evidence.

Undeniably, asynchronous electronic conferencing systems, which have become available via the World Wide Web, make it possible to extend discussions beyond class time and compensate for the limited amount of dialogical interactions in the classroom. Such systems also enable the course instructor to (a) observe and assess students' contributions to the discussions, (b) participate in the discussions and model critical-thinking skills, (c) scaffold students' thinking, and (d) encourage reflection (Bonk & King, 1998; Copeland, 1989). In addition, these systems allow more students to participate in discussions, because students may choose to participate anonymously as well as post their messages, when they are ready, without feeling any time pressure.

Case-based instruction also has the potential to foster social interactions amongst learners and teachers. It is a promising pedagogical approach in teacher education, because it creates an inquiry-based learning environment, which promotes students' participation and reflection, and helps them develop problem-solving and thinking skills (Shulman, 1992).

Therefore, given the promise of both, the web and case-based instruction, to facilitate communication, this study set out to examine the issue of fostering quality online interactions related to student-generated teaching cases. Specifically, the purpose of the study was to investigate the extent to which "*Conferencing on the Web*" (COW), an asynchronous web-based conferencing tool, could effectively support undergraduate student teachers' discussions related to difficult teaching cases, which they encountered during their early-field experiences. In effect, this instructional design combined the power of asynchronous web-based conferencing and case-based reasoning to promote student teachers' critical-thinking skills.

Methodology

Participants

In total, 146 undergraduate student teachers from one university in the United States participated in the study. Participants were completing a 20-hour early-field experience in a K-12 school, and, at the same time, were enrolled in a required educational psychology

course and in a two-credit early-field experience laboratory course. The intention of the laboratory course was to help students link early-field experiences to the educational psychology course content. During their early-field experiences, students were supposed to engage in authentic teaching situations by observing and, when needed, assisting a practicing teacher. They, thus, had the opportunity to bring issues back into the classroom for the purpose of in-depth discussion and developing their pedagogical content knowledge (Shulman, 1987).

Procedures

The online COW conference was open for six weeks and partially replaced student face-to-face discussions during the two-credit early-field experience laboratory course. Specifically, students were instructed to participate in the electronic conference by posting a teaching case that they observed in the field. In this case vignette, they were to describe a teacher and/or a student in some sort of problematic or instructionally interesting situation. In addition, these pre-service teachers were asked to provide plausible solutions to the case, based on the course readings and lectures. Each student was also asked to (a) post messages to at least four other cases written by peers, and (b) summarize the electronic discussion generated for a peer's case. Moreover, students were required to come to the lab once a week for 50 minutes. Students' performance for the early-field experience laboratory course was evaluated on a pass or fail basis depending on whether students successfully completed certain required tasks. Students' performance in COW was not assessed based on certain criteria, but participating in COW was one of the required tasks. Three COW experts provided computer conferencing training for mentors and students. During this brief training, mentors and students experienced the same practice cases and other training activities.

In COW, students received mentoring from (a) five instructors, who were teaching different sections of the laboratory course, (b) the instructor of the educational psychology course, (c) the early-field director, and (d) two conference moderators. Before participating in COW, all mentors also attended a second brief training session, where they were given a sheet with twelve forms of online assistance along with relevant examples for each form, as shown in Table 1. These examples were discussed and clarified, and mentors were simply asked to accordingly employ these mentoring techniques and moderate the COW discussions. Whereas Tharp (1993) espoused six of these mentoring forms, Bonk and Kim (1998) extended the list to twelve. For the purposes of this study, we organized the twelve forms into (a) low-level mentoring, (b) high-level mentoring, and (c) management. In high-level mentoring, the intention was to avoid giving ready answers to students, and guide them to analyze and evaluate their thinking deeper and in relation to others' perspectives. Mentors were not assessed as good or bad, but their postings were classified using the mentoring forms in Table 1.

Description of COW

COW was employed as the tool for posting the cases and other messages. It is organized into three basic levels: (a) Conference, (b) Topic, and (c) Conversation. The basic structure of COW is depicted in Figure 1.

Table 1: *Forms of electronic mentoring*

<i>ID</i>	<i>Low-level Mentoring</i>	<i>Examples of Low-level Mentoring</i>
1	Social (and Cognitive) Acknowledgement	"Hello...", "I agree with everything said so far...", "Wow, what a case," "This case certainly has provoked a lot of discussion..." "Glad you could join us."
2	General Advice/ Scaffolding/ Suggestions	"If I were in her shoes, I would...", "Perhaps I would think twice about putting these kids...", "I know that I would first..." "How totally ridiculous this all is; certainly the teacher should be able to provide some..."
3	Feedback	"That shows real insight into...", "Are you sure you have considered..."
4	Direct Instruction	"I think in class we mentioned that...", Chapter 'X' talks about...", "Remember back to the first week of the semester, when we went over 'X', which indicated that..."
5	Questioning	"What is the name of this concept?," "Another reason for this might be...", "What else might be important here...?," "Who can tell me...?," "How might the teacher...?," "What is the real problem here?"
6	Modeling/Examples	"I think that I solved this sort of problem once, when I...", "Remember that video we saw on 'X', wherein 'Y' decided to...", "Doesn't 'X' give insight into this problem in case 'Z', when he/she said...?"
	<i>High-level Mentoring</i>	<i>Examples of High-level Mentoring</i>
7	Cognitive Task Structuring	"You know, the task asks you to...", "Ok, now summarize the peer responses you have received," "How might your textbook authors have solved this case?"
8	Push to Explore	"You might want to write to Dr 'XYZ' for...", "You might want to do an ERIC search on this topic...", "Perhaps there is a URL on the Web that addresses this topic..."
9	Cognitive Elaboration/ Explanations	"Provide more information here that explains your rationale," "Please clarify what you mean by...", "I'm just not sure what you mean by...", "Please evaluate this solution a little more carefully."
10	Fostering Reflection/ Self-Awareness	"Restate again what the teacher did...", "How have you seen this before?," "When you took over this class, what was the first thing you did?," "Describe how your teaching philosophy will vary from this...", "How might an expert teacher handle this situation?"
11	Encouraging Articulation	"What was the problem-solving process the teacher faced here?," "Does anyone have a counterpoint or alternative to this situation?," "Can someone give me three good reasons why...", "It still seems like something is missing here, I just can't put my finger on it."
	<i>Management</i>	<i>Examples of Management</i>
12	Through Private E-mail or Discussion	"Don't just criticize... please be sincere when you respond to your peers," "If you had put your case in on time, you would have gotten more feedback," "If you do this again, we will have to take away your privileges."

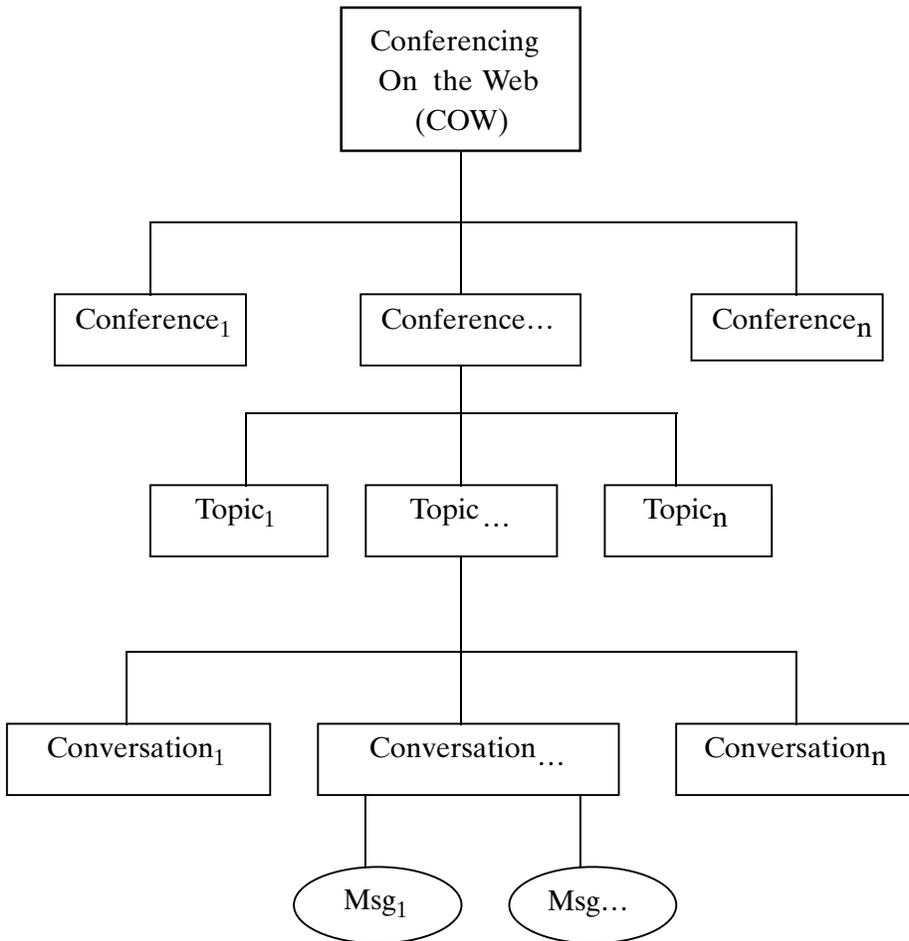


Figure 1: The structure of COW

As shown in Figure 1, the structure of COW is hierarchical, having *Conferences* at the top level, followed by *Topics* at the middle level, and *Conversations* at the base level. Messages and replies can only be posted at the *Conversation* level. Each *Conference* is organized into *Topics*, each *Topic* is divided into *Conversations*, and each *Conversation* consists of a thread of messages. Discussions in COW occur only at the *Conversation* level (ie, replying or posting messages), and new messages are posted below older messages in a linear sequence. All messages are public to every participant of any particular conference. Message permanence allows for continued reflection on others' comments and provides a log of student activity for less intrusive research.

There were many reasons for choosing to use COW in this study. In particular, we were interested in adopting an easy-to-use medium, because students were not experienced

users of technology, and we did not have the resources to provide extensive training to them. COW is an easy-to-use medium, because, in many ways, its functionality resembles that of an email facility; thus, all participating parties were able to use it with minimal training. COW was also chosen, because it did not take up a lot of server space, and immediate technical support was provided for setting the system up for the study. Lastly, COW could be used as a research tool, and, thus, we easily adapted it to collect both quantitative and qualitative data.

Data collection and analyses

In terms of this study, case discussions were saved and archived for in-depth quantitative and qualitative analyses. COW automatically provided extensive quantitative data regarding system usage, which included (a) the identification of people who accessed the system, (b) the number of cases generated, and (c) the total number of postings and their length. For the qualitative analysis, a sample of 35 discussion threads was randomly chosen for analysis. Each thread was analyzed for the quality of online dialogue and the forms of mentoring used.

Table 2 summarizes the coding scheme that was used to evaluate the quality of students' online dialogue, while the coding scheme shown in Table 1 was used to identify the different forms of online mentoring. Two expert raters (an associate professor and a graduate student) scored all 35 transcripts to determine the consistency or accuracy of the rating procedures.

Results

Overall, there were 124 cases generated for different topics and 935 messages posted. Of these messages, 818 (87.5%) were from fellow students (ie, replies to cases or case

Table 2: Indicators for the quality of students' online dialogue

<i>ID</i>	<i>Indicators</i>	<i>Examples</i>
1	Social acknowledgement/ Sharing/Feedback	<ul style="list-style-type: none"> • Hello, good to hear from you • I agree, good point, great idea • I know what you mean. I can share with you what I did when I encountered a similar problem...
2	Unsupported statements (advice/point of view)	<ul style="list-style-type: none"> • I think you should try this... • This is what I would do... • I had a similar experience and I did...
3	Questioning for clarification and attempts to extend the dialogue	<ul style="list-style-type: none"> • Could you give us more information? • Could you explain what you mean by this? • Wasn't the teacher aware that...?
4	Critical thinking/Reasoned thinking-judgment	<ul style="list-style-type: none"> • I disagree with X, because in class we discussed... • I offer an alternative to X's suggestion, because I... • I still disagree with you X, because it seems that your approach contradicts the theory about... • You may try the approach recommended by X, but I see the following disadvantages to this approach...

summaries) and 117 (12.5%) from the nine mentors. This clearly suggests that 22 students did not post a case for discussion, although they were involved in COW by posting messages to reported cases and summarizing the discussion of a peer's case. Thus, each case received on the average more than 5.6 postings, which is slightly above the minimum five postings required by each student. Mentors' messages were less than the 124 cases posted by students, which indicates their limited involvement. Postings from students and mentors averaged about 110 and 126 words, respectively. There was a 20% decrease in the number of messages posted in the second three weeks in comparison with the number of messages posted during the first three weeks. This decrease may be attributable to mentors' limited involvement in COW that was much less than the expected.

Quality of students' online discourse

The two raters individually scored the 35 transcripts, in terms of the quality of students' discourse using the four categories in Table 2, with 82% agreement. The two raters, after discussing the cases of disagreement, easily reached consensus. Based on these evaluations, 35% of students' replies included some form of social acknowledgement and general feedback, and 9% were requests for clarification and prompts for further dialogue. Only 7% of the replies were justified opinions and claims, while 49% of students' discourse was unsupported advice and personal opinions.

The following excerpts represent typical COW discussions among students, and exemplify the unjustified reasoning patterns they invoked in COW.

S₁: In one of my observation days, I noticed that the teacher never called on a student, who was raising his hand. For three hours, the student was raising his hand for almost every question, but yet never got picked to speak. How do you think this would affect the student's willingness to answer subsequent questions?

S₂: I would think that the student would eventually lose interest in that class to a certain extent. If students quit raising their hands, because the teacher will not call on them, this would also lower their self-esteem.

...

S₃: No way! This is not the proper way to teach students. If that is how teachers are supposed to teach, then why go to class? You could sit at home and learn just as much. I think that this is ridiculous, what a waste of time! This teacher needs to realize that students learn in different ways, and that not everyone can figure everything out on his (her) own. Well, I do not agree with this kind of teaching.

Forms of electronic mentoring

In terms of the raters' evaluations of the forms of electronic mentoring, there was an 81% agreement. The two raters easily resolved the points of disagreement. In all 35 cases that were analyzed, there was on the average less than one reply from mentors

Table 3: Mean percentages for each form of electronic mentoring

<i>ID</i>	<i>Low-level Mentoring</i>	<i>%</i>	<i>ID</i>	<i>High-level Mentoring</i>	<i>%</i>
1	Social (and Cognitive) Acknowledgement	12	7	Cognitive Task Structuring	1
2	General Advice/ Scaffolding/ Suggestions	31	8	Push to Explore	0
3	Feedback	11	9	Cognitive Elaboration/Explanations	0
4	Direct Instruction	8	10	Fostering Reflection/Self-Awareness	0
5	Questioning	36	11	Encouraging Articulation	0
6	Modeling/Examples	1			
			<i>ID</i>	<i>Management</i>	<i>%</i>
			12	Through Private Email or Discussion	0

to each student case. Table 3 shows the percentages for each form of electronic assistance mentors employed.

The results in Table 3 show that high-level mentoring and management were almost non-existent in the mentors’ postings. Only 1% of their postings utilized one form of high-level mentoring, namely, cognitive task structuring. Mentors were inclined to mainly employ questioning and general advice/scaffolding in their postings. Thus, questioning was the most frequent form of mentoring (36%), followed by general advice/scaffolding (31%). Another 12% of mentors’ postings represented social acknowledgement, 11% feedback, and 8% direct instruction.

The following excerpts are representative examples of mentors’ postings. The posting from M_1 exemplifies social acknowledgement and questioning for clarification, whereas the postings from mentors M_2 and M_3 exemplify social acknowledgement and unsupported advice.

M_1 : Another interesting case. What grade was this, and what subject was it? You said that the student was raising his hand for the next three hours without being called on. Was the student a minority student or somehow different? Were there other students, who were also not frequently called on? Were only certain students the only ones called on? It would certainly be interesting to know what reasons the teacher would give for not calling the student.

...

M_2 : Ok, Student X, interesting case. I personally would do the same thing. Especially if I was not making an exception... No simple answer from me here, but those teachers and administrators need to lighten up and take themselves less seriously. Be flexible and bend the rules, if one has completed the requirements.

...

M₃: Student Y, this is a tough issue. I do think learning-disabled students (usually of average or above average intelligence) should have the advantages of being in a regular classroom. But teachers need to be trained to work with them. In time, more teachers will get the training and gain the experience needed to work with mixed classes like the one you described.

Discussion and conclusions

The issue of interactivity has initially been investigated from the point of view of enabling participation in electronic conferences amongst learners and course instructors (Davie, 1988; Harasim, 1987). Thus, the focus was on the ease of accessing the system as well as the quantity of posted messages and replies. Gradually, researchers realized that the issue of interactivity was a much more complex issue to investigate, because, in addition to paying attention to quantity, attention should also be drawn to quality (Muirhead, 2001; Horn, 1994).

The quantitative data of this study showed that the potential of COW, in connection with case-based instruction, did not encourage extensive communication among the participants. Mentors' postings were less than the cases generated by students, and the average number of mentors' postings was small. On the other hand, the number of cases generated by students was less than the number of students indicating that some students did not post cases in COW, even though they participated in discussing others' cases or summarized a case. The results also showed that participants' interest in using COW started diminishing over time. Hammond (2000), in his studies with other online conferencing systems, also found a gradual decrease in the number of messages posted. Specifically, he reported a decrease of 57% and 81% between the total number of postings during the first three weeks and the second three weeks, and between the first three weeks and the third three weeks, respectively. In the present study, there was no evidence to support a gradual decrease over a period of time extending beyond the sixth week. The results of both studies clearly indicate that the online conferencing environments failed to sustain participants' initial interest and engagement beyond the first three weeks. There could be different reasons for this failure to create a true online learning community in COW.

Initially, students were expected to participate in the online conference by simply completing the task. It seems that students considered their participation in COW as a mechanical procedure that they needed to do in order to pass the course. It could also be the case that participants may have not felt that COW had any added value in their learning, because they could still meet with their instructors every week for 50 minutes to discuss learning issues, and, thus, compensate for not being extensively involved in COW.

More concerns about participants' engagement were raised when the quality of students' online discourse was put under scrutiny. The high percentage of agreement between the two raters strongly supports the validity of the findings of the qualitative analysis. The findings indicate that participants did not value online conferencing using COW as a means to discuss the teaching cases in depth; instead, for each case, they only

scratched the surface. The results showed that students' interactions did not involve critical thinking aimed at seriously examining course content. Instead, students primarily shared personal experiences amongst themselves, and their responses appeared to be too subjective and naïve at times. Students' discourse was also extremely conversational and opinionated, and showed little evidence of critical thinking. Participants were only offering opinions without grounding them on evidence from any reliable source, and they failed to reason with evidence related to educational psychology theory and concepts. The lack of an assessment strategy to evaluate students' online contributions may have influenced not only the quantity of messages posted but also their quality. These results parallel those reported by previous studies (Bates, 1995; Mason, 1991; Castro, 1988).

Another issue is related to the sample of students who participated in the study. The participants were pre-service teachers, traditionally experienced in conventional classrooms, who were taking one of their first teacher education courses. The fact that they were discussing, albeit in a conversational mode, successes and failures of experienced teachers and reflecting on such practices online may be indicative of a first level of critical thinking. Research reports (eg, Angeli, 1999; Halpern, 1999) indicate that undergraduate students are not usually disposed or inclined to think critically about an issue, but their thinking can be improved through careful planning of constructivist learning environments and well-designed facilitation strategies. Thus, the role of the facilitators or mentors becomes really important. Salmon (2000), within the context of online conferencing, also emphasizes the importance of training mentors (she calls them e-moderators) to effectively moderate the process of knowledge construction. Based on her extensive experience with computer mediated conferencing in the Open University's Business School, she found that several other techniques, besides questioning which was the most frequent online assistance form mentors used in the present study, can be employed to promote dialogue in an online constructivist environment. She discusses the importance of (a) assigning learners a role, (b) weaving together participants' online contributions, (c) probing and summarizing, (d) commenting on each other's writing, (e) reflecting and evaluating one's thinking, (f) structuring a task, (g) triggering a debate, and (h) not overwhelming the learner with lots of information; instead she recommends to provide the information when needed and not all at once. In regards to this last suggestion by Salmon, in the present study, students created 124 cases for different topics. Therefore, they might have felt overwhelmed by the number of different topics they needed to consider and the amount of information they had to process.

Likewise, other researchers (eg, Bates, 1995; Burge, 1994), in discussing the phenomenon of low levels of thinking and poor interaction in online environments, also stress the importance of well-designed mentoring strategies to promote quality interaction. In the present study, mentors' postings were limited and restricted to using only low-level questions. Due to lack of time, mentors did not use the system as much as it was expected, and, when they did, they failed to employ high-level mentoring to stimulate critical-thinking skills. Perhaps, their failure to employ high-level mentoring was due to the fact that they were not adequately trained to model critical-thinking skills in an

online environment. In addition, mentors' performance was not evaluated in any way; thus, it could be the case that they simply under-estimated their role and did not invest enough time and effort to facilitate good quality dialogue. If mentors had been kept, in some way, accountable for their scaffolding techniques, they could have employed better facilitation strategies for each case discussion.

The issue of promoting quality communication in electronic conferencing systems appears to be complex, especially when these systems are used for intentional learning and not for information dissemination (O'Donoghue, Singh, & Dorward, 2001; Bates, 1995). In the well-known debate between Kozma (1991) and Clark (1994), the question was whether the medium, as an end in itself, could influence learning, or whether it was the method delivered by the medium that promoted learning. The instructional framework of the present study employed COW, a powerful medium for online interaction, and case-based instruction, a powerful instructional method for promoting learning and critical-thinking skills. Nonetheless, the results of the study did not meet the expectations of this instructional framework. It remains to be seen whether it is possible to foster quality interactions in online conferencing systems through the affordances of a medium (Jung, 2001). COW did not afford any online structures to trigger or scaffold students' thinking. It might be the case that if second generation web-based conferencing systems support well designed built-in structures, then they may scaffold online interactions more effectively than current systems. These online structures can help students strengthen their mental powers by guiding them to engage in a process of critical and reflective thinking (Duffy, Dueber, & Hawley, 1998), provided that the teacher is adequately trained to effectively utilize these structures. This last point leads however to another issue, which has not been considered by either Clark or Kozma, namely, the issue of implementation.

Recent research evidence (eg, Clift, Mullen, Levin, & Larson, 2001; Roth, 1995) shows that the effective implementation of technology takes on meaning as part of the instructor's situated practices. Based on this rationale, we would like to draw a distinction between using a conferencing system as part of an overall online learning environment to replace face-to-face instruction and integrating a conferencing system in a traditional classroom setting as a tool to foster further communication. This distinction is important and deserves more consideration, because students may perceive the added value of the tool in each instructional situation differently. When students use a conferencing system to complete a course from a remote location, they depend on the system for understanding what they need to do in order to carry out their responsibilities. Thus, they may perceive the tool to have high added value for their learning. On the other hand, when a conferencing system is integrated in a classroom setting, as it was the case in the present study, students' perceived added value of the tool may not be that high, because students can still meet with their instructors and have a face-to-face discussion. Undoubtedly, the integration of conferencing systems in classroom settings constitutes a complex issue that presupposes good instructional design skills for engaging online learning activities, which learners will perceive as challenging and valuable for their learning. Online activities must also be designed in a way that cannot be easily

or productively undertaken offline (Salmon, 2000). Moreover, students and mentors must be kept accountable for their online contributions; thus, appropriate assessment strategies must be developed for evaluating the quality of online discourse. Moreover, as always, clear and well-understood learning goals are necessary for guiding students' learning in an online learning environment. Lastly, instructors, mentors, or e-moderators must be well trained to take full advantage of the affordances of any employed electronic conferencing system.

In conclusion, it is important to keep on studying the issue of interactivity as more and more people continue, or even pursue for the first time, formal training using distance-education methods. It is also important that in our future research designs, we investigate a multiplicity of motivational and affective variables related to the implementation of distance-education methods, and the way teachers' or mentors' behaviors affect students' involvement and learning.

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