

Teacher and Student Behaviors in Face-to-Face and On-Line Courses: Dealing with Complex Concepts

C.E. (Betty) Cragg, Jean Dunning and Jaqueline Ellis

Abstract

The objective of this research was to compare the quality and quantity of teacher and student interaction in an on-line versus face-to-face learning environment. A Master's level course on nursing theories was taught by the same professor by both methods. Transcripts of the face-to-face class and on-line postings were analyzed to identify professor behaviors and also to rate the levels of student responses using the Gunawardena, Lowe and Anderson (1997) Analysis Model for Social Construction of Knowledge. Categories of teacher behaviors were identified and frequencies calculated in each course. While numbers of interventions were different, the professor showed similar facilitation behaviors in both environments. Student participations were counted and rated using the five major phases of the model. While most student interactions reflected the lower levels of the model, some students in each delivery context demonstrated higher levels of knowledge construction. Students experiencing each delivery method were successful in the course and mastered complex, abstract concepts.

Résumé

L'objectif de cette étude était de comparer la qualité et le nombre des interactions enseignante-étudiants dans un environnement en ligne et dans un environnement en face à face. Un cours de niveau maîtrise sur les théories en sciences infirmières a été donné par la même enseignante selon les deux modes. Des transcriptions des échanges en classe et en ligne ont été analysées pour identifier les comportements de la professeure et pour évaluer les niveaux de réponse des étudiants à partir du « Analysis Model for Social Construction of Knowledge » de Gunawardena, Lowe et Anderson (1997). Des catégories de comportements de l'enseignante ont été identifiées et des fréquences calculées pour chaque mode de prestation du cours. Alors que le nombre d'interventions était différent, la professeure a montré des comportements facilitateurs similaires dans les deux environnements. La participation étudiante a été comptée et évaluée selon les cinq niveaux du modèle d'analyse. Bien que la plupart des interactions étudiantes se situaient aux niveaux inférieurs du modèle d'analyse, quelques étudiants dans chacun des environnements démontraient des niveaux plus élevés de construction de connaissance. Des étudiants de chacun des deux modes de prestation ont réussi le cours et ont maîtrisé des concepts abstraits complexes.

Introduction

Teaching abstract concepts at the graduate level can be a challenge to any professor, especially when the students are professionals whose practice experience has led them to focus on concrete clinical problems rather than the philosophical foundations of the profession. The on-line learning environment adds to the difficulty of the professor's task because students are expected to delve into the abstract and complex issues related to the theoretical basis of a profession without the spontaneous give and take of the face-to-face seminar. The face-to-face environment allows the professor to interpret non-verbal student communication and identify puzzling and problematic areas of learning. In asynchronous discussion of abstract concepts, it may be difficult for students to reach the higher levels of construction of knowledge individually and as a group since the teacher is not able to provide immediate feedback to students as they grapple with difficult concepts.

Our nursing Master's program offers courses in both on-line and face-to-face formats. The same professor was assigned to teach Advanced Nursing Theory by both delivery methods. She was intrigued by the challenge of helping distance students master the conceptual material that most students struggle with in a traditional classroom. Subsequently, she joined colleagues who were interested in examining the use of technology in education to compare what happened in the face-to-face and on-line environments. The parallel offering of the same course in two learning environments in otherwise similar circumstances provided an opportunity to examine how the e-learning environment affects teacher-student and student-student interaction and the ability of students to reach the required levels of abstract comprehension of complex concepts. The nature of the course and the difficulty that students have experienced over the years in relating to and mastering the content makes it particularly important to examine the implications of a new learning environment for professor behaviors and student learning. The goal of the study was to compare the quality and quantity of professor-student and student-student interaction in both delivery methods. We examined the role of the professor in the two environments, and the frequency and content of student participation in order to identify whether behavior patterns and construction of knowledge varied by delivery mode and whether students exhibited similar levels of comprehension of the complex subject matter addressed by the course. Social construction of knowledge was chosen as the appropriate theoretical base for examining student participation because it considers that though interaction of learners with each other, with the facilitator and with the content, based on previous learning and experience, new understandings are developed

(Peters, 2000; Prawat & Floden, 1994; von Glaserfeld, 1993; Vygotsky, 1978).

The Course

Advanced Nursing Theory is a graduate level course in the Masters of Nursing Science program that most students take early in the program. The goal of the course is to introduce students to the philosophies and theories that currently guide nursing knowledge development. It requires students to link and apply abstract concepts to discussions of nursing knowledge and praxis. While all students have a baccalaureate degree in nursing and most have taken a course in nursing theory as undergraduates, the level of conceptualization and abstraction expected in this course is considerably higher than the undergraduate expectations. Most of the students had been in practice as Registered Nurses for at least two years, and might not have used much abstract conceptualization in their day-to-day clinical practice. However, they brought considerable professional experience to the discourse.

The professor took a social constructive approach to knowledge development in both contexts (Peters, 2000). Students at this level bring considerable personal and professional experience to their learning. The professor's approach, in both the face-to-face and on-line environments was to provide facilitation and guidance, encouraging students to interact with her, their fellow students, and the readings to construct their own meanings and identify applications to their professional practice.

The course was organized into weekly discussion topics with required readings. In the face-to-face course, the students met with the professor for a weekly three-hour class. The expectation was they would come to class having read the assigned readings. During class, the professor would present mini-lectures with PowerPoint slides at intervals, after which there would be opportunities for discussion. Students were expected to interact and debate with each other and the professor, bringing their readings and experience to bear on creating meaningful understanding of how the concepts under consideration applied to their practice environments. In the on-line course, students had the same readings and the professor started off the weekly discussions with questions and comments, but did not present any preliminary didactic material. Students interacted through on-line, asynchronous discussion boards. They were expected to interact with their peers and the professor, basing discussion on the reading material, to develop a better understanding of the content and its application. There was a mark in the course for participation.

There was a maximum of 20 students in each class. Topics included nursing epistemology and ontology, knowledge development and analysis, types and levels of theory, concepts and concept development, theory development, post-modernism, theory analysis and evaluation, truth, and praxis.

Assignments for both versions of the course included short papers examining specific topics previously discussed in the course. A final paper was the analysis of a concept selected by the student, relevant to nursing and the course. In both courses, the professor gave extensive feedback on the assignments and met, in person or by telephone, with students who were struggling to achieve the level of comprehension and analysis expected in the course.

Research Objective

The objective of the research was to assess the quantity and quality of teacher-student interaction in a graduate course delivered by the same teacher via face-to-face or on-line methods. More specifically, the study sought to examine the role of the professor in facilitating discussion in the two environments and analyze the frequency and content of student participation in the two delivery modes.

Literature Review

A number of researchers have examined critical thinking as reflected in on-line discussions (Bullen, 1998; Gunawardena, Lowe & Anderson, 1997; Henri, 1992; Kanuka & Anderson, 1998). In addition, there is considerable literature comparing distance education and face-to-face offerings, mainly based on student success in evaluation measures, student attitudes, or overall student satisfaction (Merisotis & Phipps, 1999). However, there is a dearth of literature analysing and comparing the content of face-to-face and on-line course discussion or direct comparisons of the same course offered by face-to-face and on-line methods. Ryan, Carlton & Ali (1999) examined Master's level nursing students' perceptions of face-to-face and on-line experiences in a course that included both delivery methods and reported students rated classroom methods significantly higher on content, interaction participation, faculty preparation, and communication. Technical skills were rated higher for the web-based portion. Critical thinking and time for assignments were not rated as significantly different.

Analysis of on-line courses and assessment of the level of discourse through content analysis of contributions of participants to on-line discussions has been common since the beginning of on-line discussions in the 1980s. There have been concerns about the cognitive levels and

types of interpersonal interaction achieved in on-line discussion, since the typical interactions of the face-to-face environment are modified by the technology (Lapointe & Gunawardena, 2004; Lee & Busch, 2005; Marra, Moore & Klimczak, 2004; Murphy, Mahoney, Chen, Mendoza-Diaz & Yang, 2005).

According to constructivist learning theories, how we construct knowledge depends on what we already know and the kinds of experiences we have had (Kanuka & Anderson, 1998; Vygotsky, 1978). In addition, collaborative learning is central to constructivist learning (Maor, 2003; Schellens & Valcke, 2006). Social constructivism is a useful approach to the analysis of on-line behavior, since the mutual construction of knowledge in a virtual group is a desired outcome that can be assessed through analysis of transcripts. This construction of knowledge and appreciation of its application to the real world is particularly useful as an approach to looking at mastery of the content in a nursing theory course that seeks to give participants a foundation on which to build their future practice. Use of a framework like social constructivism allows the distance educator to assess the efficacy of on-line discourse to alter and enhance the understanding of the participants (Gunawardena, Lowe, & Anderson, 1997). While there has been much content analysis of transcripts of on-line discourse, little systematic comparison of on-line and face-to-face course interactions was found in the literature.

Methods

Funding was obtained from a Teaching/Learning grants program at the university and ethical approval was obtained from the university's ethics review board. Students were then invited to participate in the study. On-line students were asked to give permission for analysis of their postings. Postings of those who refused or did not respond were removed from the transcripts. Face-to-face students were asked to give permission for audio tape recording and transcription of classes. A research assistant, who was the only person who knew which students had given permission, taped and transcribed each class, omitting the contributions of those students who had not given consent. Transcripts of nine classes where new material was presented and discussed were analyzed for both professor and student behaviors.

Professor Behaviors

We were unable to find a published rating scale for professor behaviors at this level; therefore, we conducted a content analysis to identify common behaviors of the professor. The researchers separately coded professor

contributions to the discussions and each identified categories of professor behavior. The category titles were negotiated among the group and inter-rater reliability was assessed based on assignment of the same behavior codes to the same messages in the transcripts (see Table 1). Professor behaviors were coded and then tallied. Word counts were used to determine the percentage of total contributions to each class that were made by the professor. While the counts and behaviors did not explicitly look at constructivist interventions, they did indicate a facilitative style that could promote student knowledge construction.

Student Behaviors

Gunawardena et al. (1997) have developed a tool, the Interaction Analysis Model, based on social construction theory for analyzing social construction of knowledge where transcripts of course processes are available. In analyzing student behaviors, we read each posting and transcript in sequence and applied the Gunawardena et al. phase or phases that applied to the segment being analyzed. The unit of analysis was considered to be the illocutionary unit (or complete message contained in the passage) (Rourke, Anderson, Garrison & Archer, 1999; Schellens & Valke, 2006). Individual sentence analysis proved too small a unit to enable a comprehensive understanding of the theoretical constructs in the model. As pointed out by Schellens & Valke, the advantage of using the complete message was that it was the division selected by the participant. Each student/professor message, whether it was a posting in the on-line course or a comment in the face-to-face class was analyzed for the phases of learning as outlined by Gunawardena et al. (1997). In some cases we coded multiple sentences or paragraphs with a single phase code. However, many postings contained multiple paragraphs and addressed several topics. Therefore, we often assigned two or more phase codes to the same posting or transcript entry. Messages also had to be considered in the context of the broader discussion since social construction of knowledge requires building from one interaction to the next. For example, discovery and exploration of dissonance requires an initial statement that raises disagreement. Each transcript was coded by two researchers to ensure inter-rater reliability. Differences in coding were discussed and negotiated among the researchers until agreement was reached.

The nine transcripts of each course were coded to assess each student's learning progress. Knowledge construction was identified by the researchers as an appropriate criterion for assessing the student's ability to think conceptually and at the highest levels. The Model (Gunawardena et al. 1997) was based on a study to develop interaction analysis techniques that would reflect whether participant contributions to on-line

discussions indicated social construction of knowledge. It has five major phases: 1) sharing/comparing information; 2) discovery and exploration of dissonance; 3) negotiation of meaning and/or co-construction of knowledge; 4) testing and modification of the proposed synthesis or co-construction and; 5) phrasing of agreement, statement(s), and applications of the newly constructed meaning. Each phase also has several sub-phases that could be used for coding statements. However, since inter-rater reliability was strongest for the five major phases, only this level of analysis is reported in this study.

In order for students to demonstrate optimum learning in the course, it was felt that they should contribute at the higher levels of constructivism as they progressed through the semester. In addition to the qualitative analyses of the professor and student contributions to the courses, word counts and numbers of contributions were tallied to see if on-line participants demonstrated different levels and frequency of participation. The number of times students demonstrated each level of knowledge construction was also recorded. While reductionist, the strategy of counting participant contributions in general and those at each phase of construction allowed comparison of qualitative and quantitative differences in discussion occurring in the two delivery methods.

Findings

Demographics

The professor was an experienced educator with a PhD in nursing who had taught the face-to-face course for seven years. However, she was new to the on-line environment. Eighteen face-to-face students and 10 on-line students agreed to participate in the study. There were 27 females and one male; 22 part time and six full time students. Median age for the group was 39 years (37 for face-to-face and 42 for distance students). Their median working experience was 16.5 years. Twenty-one of the 28 students were in their first year of the program; 16 students had taken at least one Master's level course previously. Eighteen students had taken at least one baccalaureate level Philosophy course. Eleven, (6 face-to-face and 5 on-line) students, had taken an on-line course previously.

Word Counts

The professor contributed 71,353 words to the face-to-face course, or 70% of the words in class. New topics or concepts were introduced by the professor in short introductory lectures which account for many of the words. In the on-line course, the professor only contributed 13,207 words or 22% of the posted words. The types of contributions for professor behaviors fell into four major categories: *Giving Information, Questioning,*

Affirming, and *Blocking*. Within *Giving Information*, there were subcategories of *explaining*, *stating a position*, *restating a position*, *directing* what happened in class or on-line for the topic under discussion, and *thinking aloud*. *Questioning* had two subcategories—*clarifying* what the previous speaker had said and *stimulating* participants to take an idea further. *Affirming* behaviors included the two sub-categories of *praising* participants or *agreeing* with them. *Blocking* was identified only in the face-to-face class when the professor cut off a student's contribution. See Table 1 for frequencies of these behaviors.

Word counts among student contributions varied widely. In the face-to-face class, the maximum number of words contributed by a single student was 8,252 and the minimum was 159 words. On-line students had more of the “air time” in the course, with the professor only contributing 22% of the words, but they also tended to have higher word counts than the face-to-face students. The maximum number of words on-line was 8,286, while the minimum was 1,034.

Qualitative Analyses

In both delivery methods, students demonstrated all five levels of knowledge construction. Examples of their demonstration of the five phases of Gunawardena et al.'s (1997) model are provided in the following paragraphs. Note that out of context, it may be difficult to

Table 1. Categories of Professor Behaviors

Category	*Face-to-Face (n = 841 codes)	On-Line (n = 239 codes)
Giving Information:		
Explaining	23.6%	17.6%
Stating Position	9.9%	15.9%
Restating Position	7.6%	4.1%
Directing	9.9%	13.8%
Thinking Aloud	3.0%	1.3%
Questioning		
Clarifying	11.1%	8.8%
Stimulating	17.6%	22.6%
Affirming		
Praising	6.1%	11.7%
Agreeing	7.8%	4.6%
Blocking	3.4%	0%

*Face-to-face = 18 students; on-line = 10 students

assess the level of a statement, but as part of an ongoing dialogue, it became clear that the students' intent was to propose, test, or reach agreement with others on the understanding of the issue under discussion. Therefore the last statement in a conversation, whether face-to-face or on-line, may demonstrate building on previous contributions by that student and others to reach that particular level of discourse.

Phase 1. Sharing/comparing of information: "I agree that measuring nursing practice using such time-sensitive tools as GRASP is time consuming and does not reflect all that the nurse does during her day"

Phase 2. Discovery and exploration of dissonance or inconsistency among ideas, concepts or statements:

"I really cannot agree that the concept of health is ambiguous. Health, as a concept seems pretty concrete."

"Do we have to label ownership to knowledge? Do we have to say this is nursing knowledge, this is medical knowledge, this is ...?"

Phase 3. Negotiation of meaning/co-construction of knowledge:

"I reflect back on my journey in theory over the past few weeks, some things I see differently, some not, and some I am still on the fence about. I think that theory guides all practice irregardless of level of nursing."

Phase 4. Testing and modification of proposed synthesis or co-construction:

"Practice, as in nursing practice, relates to how we do things at the bedside. Praxis, as in nursing praxis, relates to why we do things at the bedside, and then the task is executed. I also want to say that practice and praxis go hand in hand, because in order to have praxis, one must have a particular practice. But on the flip side, a nurse may practice nursing but not realize or understand why they are doing what they are doing."

Phase 5. Agreement statement(s)/ applications of newly-constructed meaning:

"In my view, the art and science of nursing are not dichotomous entities. The art must be informed by and legitimized through science." All levels of knowledge construction were demonstrated in both groups, with Phase 1 being the most common and Phase 5 rarely achieved, and not by all students. This was expected, since in the constructivist paradigm, participants must state positions and counter-arguments in order to identify varying points of view and eventually co-construct a new meaning (Gunawardena et al., 1997). This co-construction occurred in both course environments. See Table 2 for frequency of codes recorded in each course delivery mode for each of the phases.

Table 2. Phases of Student Knowledge Construction in Face-to-Face and On-Line Environments

Phases	Face-to-Face Total = 724 codes	On-Line Total = 420 codes
1. Sharing/comparing information	53.5%	64.8%
2. Discovery and exploration of dissonance	21.2%	19.5%
3. Negotiation of meaning and/or co-construction of knowledge	18.1%	10.5%
4. Testing and modification of the proposed synthesis or co-construction	6.4%	4.0%
5. Phrasing of agreement statement(s) and applications of the newly constructed meaning	0.9%	1.2%

Discussion

While there were differences between the two teaching/learning environments, there were many similarities. Word counts and identifying numbers of interactions at each phase of knowledge construction do not truly reflect the personal learning that has occurred. However, they do provide a means of structuring the comparison of interactions that occur in what may be perceived as very different discussion contexts (face-to-face vs. computer conferencing, synchronous vs. asynchronous). Some students in both groups demonstrated achievement of the higher levels of knowledge construction in the course discussions. Both environments allowed students to reach the higher levels. It can be argued that on-line students were not hampered despite lacking the spontaneous exchanges of the face-to-face environment and the professor's rapid recognition of student difficulty in comprehending the material. These students demonstrated that they could enhance their understanding of abstract concepts through on-line discussion as well as through face-to-face interaction.

In both environments, some students never reached the higher levels of discourse and patterns of interaction varied widely. Data that would have been useful for identifying the impact of student behaviors in discussion on ability to demonstrate the desired outcomes of the course would have been grades that students received for their assignments in the course. During analysis of class transcripts, the researchers realized

that students demonstrated their understanding most completely in the written work used for evaluation. We did not ask for permission to access information about student grades, and the assignments had been returned to the students and therefore we did not have a complete picture of whether demonstrating higher levels of knowledge construction in class was reflected in better analyses in papers and higher grades.

The teacher's interactions in the on-line course evolved to adopt the role of facilitator of discussion, de-emphasizing her role of content delivery. However, much of her time in the face-to-face context was spent on facilitating. In the facilitation role, she displayed similar behaviors in both learning environments. On-line, she continued to use many of the teaching and interaction approaches that had proven effective in the face-to-face environment.

Students in the two delivery contexts interacted differently with the sources of course content. In the face-to-face section, the students waited until the professor had introduced a topic and then interacted with the professor and each other, incorporating the readings. The primary source of discussion material for the on-line students was the readings assigned to the topic. They then initiated discussion with each other and the professor. Thus, in the on-line environment, the professor played a smaller role in the initial transmission of material, although her intervention in both milieus helped students in their mutual construction of meanings.

Conclusion

While there were some differences in teacher behaviors and student interaction patterns in the two delivery methods, there were more commonalities than differences. The professor was more active (as identified by word counts) in the face-to-face class, however, the types of interactions with students were similar in both contexts. In addition, students in the face-to-face course interacted mainly with the professor and to a lesser extent with other students while most student on-line discussions were directed towards other students. It would appear therefore, that on-line students relied more on the course readings and each other than the professor to meet learning objectives. Strategies could be developed to enhance student-student interaction, whatever the delivery method. Such strategies might include in-class debates, and structured opportunities for students to respond to each other's ideas and questions.

Some students never reached the higher levels of knowledge construction, regardless of delivery method. Construction of meaning is not a linear process and is not limited to one course but should occur over

the entire program of study. However, teaching strategies used in either environment should be tailored to target and then challenge those students identified as less able to reach higher levels of knowledge construction. Such strategies might include providing readings that present opposing views of topics and requiring students to support a particular point of view.

Despite the professor's concerns that it might be more difficult to work with distance students to facilitate comprehension of complex abstract concepts, most students were able to achieve higher levels of knowledge construction and thus meet the course requirements. It is challenging to help students master abstract conceptual material, however, they were able to do this equally effectively in both the on-line and face-to-face learning environments.

References

- Bullen, M. (1998). Participation and critical thinking in online university distance education. *Journal of Distance Education*, 13(2).
- Gunawardena, C.N., Lowe, C.A., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research*, 17(4), 397-431.
- Henri, F. (1992). Computer conferencing and content analysis. In A. Kaye (Ed.), *Collaborative learning through computer conferencing* (pp. 117-136). Berlin: Springer-Verlag.
- Kanuka, H., & Anderson, T. (1998). Online social interchange, discord and knowledge construction. *Journal of Distance Education*, 13(1).
- Lapointe, D.K., & Gunawardena, C.N. (2004). Developing, testing and refining of a model to understand the relationship between peer interaction and learning outcomes in computer-mediated conferencing. *Distance Education*, 25(1) 83-106.
- Lee, J.A., & Busch, P.E. (2005). Willingness to participate in distance education. *Journal of Educational Research*, 99(2) 109-115.
- Maor, D. (2003). The teacher's role in developing interactions and reflection in an online learning community. *Education Media International*, 40(1/2) 127-137
- Marra, R.M., Moore, J.L., & Klimczak, A.K. (2004). Content analysis of online discussion forums: A comparative analysis of protocols. *ETR&D*, 52(2) 23-40.
- Merisotis, J.P., & Phipps, R.A. (1999). What's the difference? Outcomes of distance vs. traditional classroom-based learning. *Change*, 31(3) 12-17.
- Murphy, K. L., Mahoney, S.E., Chen, C.Y., Mendoza-Diaz, N.V., & Yang, X. (2005). A constructivist model of mentoring, coaching, and facilitation online discussions. *Distance Education*, 26(3), 341-366.
- Peters, M. (2000). Does constructivist epistemology have a place in nurse education? *Journal of Nursing Education*, 39(4), 166-172.
- Prawat, R., & Floden, R. (1994). Philosophical perspectives on constructivist views of learning. *Educational Psychology*, 29(1) 37-48.
- Rourke, L., Anderson, T., Garrison, D.R., & Archer, W. (1999). Assessing social presence in asynchronous text-based computer conferencing. *Journal of Distance Education*, 14(2), 50-71.

- Ryan, M., Carlton, K.H., & Ali, N.S. (1999). Evaluation of traditional classroom teaching methods versus course delivery via the World Wide Web. *Journal of Nursing Education*, 38(6), 273-277.
- Schellens, T., & Valcke, M. (2006). Fostering knowledge construction in university students through asynchronous discussion groups. *Computer & Education*, 46, 349-370.
- von Glaserfeld, E. (1993). Questions and answers about radical constructivism. In K. Tobin (Ed.) *The practice of constructivism in science education* (pp. 23-38). Washington: AAAS Press.
- Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Betty Cragg is a professor and former Director, School of Nursing, Faculty of Health Sciences, University of Ottawa. E-mail: bcragg@uottawa.ca

Jean Dunning is a former assistant professor, now part-time lecturer, School of Nursing, University of Ottawa. E-mail: jdunning@uottawa.ca

Jacqueline Ellis is an associate professor, School of Nursing, University of Ottawa. E-mail: jellis@uottawa.ca
