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Gunawardena, C. N. (2001). Reflections on evaluating online learning and teaching. In E. J. Burge and M. Haughey (Eds.), <u>Using learning technologies: International perspectives on practice</u> (pp. 115-124). London: Routledge Falmer.

REFLECTIONS ON EVALUATING ONLINE LEARNING AND TEACHING

Charlotte N. Gunawardena

Introduction

As electronic knowledge networks transform the way we teach and learn, a critical challenge facing us is the development of appropriate methodologies and tools for evaluating online learning. The nature of online learning projects which are time-independent, text-based and computer-mediated, the multiple threads of conversation, and the fluid participation patterns pose different kinds of challenges to evaluators. Online learning designs tend to be based on constructivist and learner- centered principles which act to increase learner control, facilitate the sharing of multiple perspectives, and emphasize individual learners creating their own meaning as described by Jonassen et. al. (1995). The meeting of behavioral objectives, with the same stated outcome for all learners, is not the goal of many online learning projects. Traditional evaluation methods used to evaluate learning within the four walls of a classroom do not transfer well to the online context. Evaluators therefore, are challenged to understand the nature of the online medium and its social and ecological structure in order to develop new principles for evaluating learning.

In this chapter, I will discuss my decade of evaluation activities relating to online learning experiences, with a focus on methods. These online experiences range from setting up online networks for social interaction, facilitating collaborative learning experiences among graduate students in several universities, moderating worldwide online professional development activities, and teaching entirely online. Most of my online experiences relate to my role as a professor at the University of New Mexico where I teach graduate level courses in distance education and educational telecommunications. In this

respect, I would like to acknowledge the valuable lessons I have learned from many students and colleagues who have collaborated with me and helped me develop my understanding of how learning occurs in online networks. For me the greatest value of online learning is in the concept of "networked learning," the opportunity to engage in collaborative, reflective learning for an extended period of time with individuals who may be thousands of miles apart, in very different time zones. As I study online learning, I am more interested in discovering the "process" of learning rather than the "product," that is, how did this specific online group share multiple perspectives, negotiate meaning, and come to new understandings? and how did individual participants in this group, change their own perceptions as a result of this group process? One of the difficulties I have experienced as a practitioner however, is assigning individual worth to collaborative group learning processes, when institutional policies often require assessment of individual learning.

There are many definitions of evaluation in the literature and many textbooks on how to conduct an evaluation (Guba and Lincoln 1981, Patton 1986, Preskill and Torres 1999). For the purpose of this chapter, I would like to define evaluation as a purposeful and systematic inquiry that includes collecting, analyzing, and reporting data relating to the appropriateness, efficiency, effectiveness, value, and outcomes of a process, product, or program. When I develop an evaluation plan, I include both evaluation and research questions. Evaluation questions center on the value or outcomes of a program, and research questions focus on why we saw certain outcomes. As I outline my work I ask myself these questions : when I evaluate online networks, what questions do I ask?; which methods do I use to address these questions?; what are some illustrative examples from my practice relating to these questions, principles and procedures?; and what are the key issues I face as I carry out these evaluations?

Online learning is complex, and we should not limit evaluation to a single question or method. This chapter shows the range of questions I have asked and the methods used to find some answers. The questions refer to participation, learner satisfaction levels, instructor experiences, and knowledge construction.

How may we describe participation?

The term participation here refers to message frequency, interaction patterns and group dynamics. Participation analysis techniques examine the capacity of a conference to engage members and reveal comparative patterns of participation among learners from varying backgrounds. Questions I have asked related to student participation and interaction patterns include: (1) who were the participants, and what were their response obligations in relation to the required online tasks? ; (2) was the computer conference sufficiently interesting and worthwhile that people became and remained involved? ; and (3) how can we describe the pattern of online interactions and group dynamics?

One evaluation tool I have found useful is the interaction analysis model developed by Levin, Kim and Riel (1990). Its four dimensions of analysis -- participant structures, inter -message reference, message act , and message flow keep my evaluator's eyes on the broad view of network organization and activities. We used this model to evaluate a peer support network for University of New Mexico (UNM) medical students who needed a social and psychological support network while they worked with preceptors in isolated rural communities in New Mexico (Gunawardena, Gittinger, and Dvorak, 1991). Participant Structures Analysis indicated that the use of the system was voluntary, no assignments were posted, and no expected level of use was required. Inter-message Reference Analysis resulted in a message map stretching to several sheets of pasted paper with lines drawn in every direction, showing the relationship between messages. We wondered whether this analysis was worth the effort, but it showed that messages referenced three and four times contained content associated with solving a puzzle or playing a game. This result suggested to us that when there was a common goal -- even in a network set up mainly for social interaction -- more participants were likely to interact. Our analysis also indicated that making participants comfortable with the use of the technical system early led to immediate and continued use of the system.

Message Act Analysis revealed that the medical students interacted in a "thread" pattern rather than a "star" pattern, most probably because no specific discussion topics were introduced. There were no persons online holding power (for example, a faculty member who would have evaluated a message or instructed participants to discuss a particular topic). We found the Levin, Kim & Riel model insufficient for exploring the nature of the interactions. In this quantitative analysis of messages, no provision was made for addressing the "content" of interactions, a shortcoming recognized by the authors themselves. We (Gunawardena, et al. 1991) therefore suggest expanding the Levin, et al. model to include content analysis based on qualitative research techniques as part of message act analysis. Using content analysis we were able to get at the flavor of the online social network and understand the kinds of activities medical students engaged in their respective rural communities. Message Flow Analysis revealed that students took seven weeks to become comfortable with the system as a communications tool but after that point they were consistent users until two weeks prior to the end of the preceptorship. In reflecting later on our use of this model, we found that while it is a good starting point for obtaining a broad picture of the network group, its activities and interaction, it has limits and that we would be better served with an evaluation model that helped us gather other data such as unsolicited and solicited participant reactions online and instructor and student perspectives on interaction. In a more recent study, Sudweeks and Simoff (1999) extend the Intermessage Reference Analysis procedure described by Levin, Kim and Riel, in a method called "Neural Network Analysis." An added feature of this model is the application of numerical values to the strength of interrelationships between messages to produce a dynamic model rather than a map. While Sudweeks and Simoff present a quantitative method of content analysis, they also present a qualitative method of analyzing the "dimensions" of a conference. McDonald and Gibson (1998) have used another method, transcript analysis, to examine interpersonal dynamics and group development in computer conferencing.

Are Learners Satisfied?

The methods I have used most often to solicit learner reactions to and satisfaction with online learning experiences include online surveys, paper and pencil surveys, and participant reactions posted online in a designated conference area. Another important source of data is the mass of unsolicited comments visible throughout conference transcripts. Structured survey questions help get an overall view

of student reactions to the conference and their satisfaction. It is also possible to obtain more in-depth data on selected open-ended questions. Needs Assessment surveys administered before the start of a computer conference enable us to get a picture of learner characteristics so that the conference and support system can be designed to meet learner needs and skills. The survey is an easy vehicle to obtain data when students are scattered across geographic distance. Analysis of survey data has taken many forms depending on the questions I have asked.

Using survey data and quantitative analysis, I have explored in two studies (Gunawardena and Zittle, 1997; Gunawardena and Duphorne, 2000) answers to this question: What are the variables that can predict student satisfaction in online learning networks? Both my studies use survey data from the inter-university "GlobalEd" online conference that enabled fifty graduate students from five universities to discuss research and experience distance education by using CMC. In the 1997 study, eight process variables were used to predict overall student satisfaction with the conference. These eight independent variables were social presence (or the degree to which a person is perceived as "real" in mediated communication (Short, Williams, and Christie, 1976)), active participation in the conference; attitude toward CMC; barriers to participation which included technical problems and lack of access; confidence in mastering the CMC system; perception of having equal opportunity to participate; adequate training in CMC at participant's site; and technical skills and experience in using CMC. Our stepwise regression analysis converged on a three-predictor model revealing that social presence, student perception of having equal opportunity to participate in the conference, and proficiency in technical skills accounted for about 68% of the explained variance. Social presence alone contributed about 60% of this variance, suggesting that it may be a very strong predictor of satisfaction. Although we cannot generalize these results because of sample selection and size, the results suggest that social presence alone is a strong predictor of satisfaction in a text-based computer conference.   This finding supports prior research that showed that the relational or social aspect of CMC is an important element that contributes to the overall satisfaction of task-oriented or academic computer conferences (Walther, 1992; Baym, 1995). Our later study (Gunawardena and Duphorne, 2000) explored predictors of learner satisfaction in a computer conference, basing the analysis on the Adult Distance Study Through Computer Conferencing (ADSCC) model developed by Eastmond (1994) using grounded theory approaches. Eastmond identified the three major

aspects which sequentially influence the student's study experience as readiness -- the personal and environmental factors that prepare the student for study in this instructional situation; online features -- the unique elements that make up the computer conferencing environment; and learning approaches -- the general and specific learning strategies used by a student to make the conference an effective learning experience. In our study, we adapted the Eastmond ADSCC model, and tested it's predictive power by examining which of the three independent variables, i.e., learner readiness; online features; and CMC-related learning approaches, could best predict the dependent variable, learner satisfaction with an academic computer conference. The linear multiple regression analysis showed that 56% of the variance in learner satisfaction is associated with the three variables. The online features variable is the best predictor of learner satisfaction: 28% of the variance in learner satisfaction scores is uniquely associated with online features. We can argue that the adapted version of the ADSCC model is a fairly good predictor of learner satisfaction with an academic online conference.

When reflecting on my various quantitative analyses, I think that their strengths lie in their ability to show salient differences in student characteristics or process variables as they relate to learner satisfaction. One of the shortcomings of such analyses however, is my inability to explain the reasons for the significant differences observed. So qualitative analyses of open-ended questions or interviews become useful. A related problem with quantitative analysis (when applied to online contexts) is the typical small sample size in many conferences and problems related to sample selection -- random sampling is difficult in distance education contexts because distance students often self-select the distance education option. Quantitative analyses should be performed only when there is an adequate sample size to study the variables of interest. Qualitative data used in conjunction with quantitative data can usually explain the significant differences found. Therefore, I advocate a mixed methodology approach (Tashakkori & Teddlie, 1998) combining quantitative and qualitative data to overcome some of the problems related to quantitative data alone.

How do teachers experience online work?

Teacher reflections on facilitating online learning experiences provide an excellent means of engaging in practitioner evaluation and understanding the successes, frustrations, and messiness of online

projects. While it is possible to interview teachers to collect such data, a technique that has worked well for me is to work collaboratively with colleagues who have participated in online projects to reflect on and write about our own experiences, and from these derive guidelines for designing future computer conferences. The GlobalEd inter-university computer conference that linked graduate students in several universities in the U.S. and Australia to participate in collaborative research was an excellent example of teacher collaboration at every phase, and provided an opportunity for those of us who participated, to reflect on our own online teaching experiences within our institutional contexts. Using teacher self-reflections as evaluation data enabled us to understand what worked well and did not work well in different institutional contexts and develop guidelines for designing better collaborative projects in the future. We discuss our self reflections in Gunawardena et. al 1994; Murphy et al. 1995; and Rezabek et al. 1994. As I have designed and facilitated international online learning projects, I have realized the importance of examining cultural issues that impact group dynamics and interactions online. I started examining these issues after I facilitated collaborative learning experiences between my students and graduate students at the University of Guadalajara in Mexico. We found three aspects of cultural differences, individualism-collectivism, power distance, and high context and low context communication to influence interactions and group dynamics in asynchronous computer mediated communication which is text-based, time-independent, and devoid of non-verbal communication codes (Wilson, Gunawardena, & Nolla, 2000).

Another approach to practitioner evaluation is examining the role changes we undergo as teachers in the online context. I discuss my own role changes and the adjustments I had to make from a teacher-centered instructional paradigm to a learner-centered one when teaching online in Gunawardena, 1992. See Annand and Haughey (1997) for naturalistic inquiry approaches used to examine six instructors' experiences with computer conferencing; see Salmon (2000) for additional evaluative commentaries.

How do learners experience online activity?

How does the individual learner make sense of the computer conference? What is he or she learning? These questions are more difficult to answer if we subscribe to a constructivist view of learning where the individual learner is expected to use various

contextual resources and guidance to construct her/his own conceptual frameworks. Traditional methods of measuring learning using pre and post tests will not work well in this context because learning occurs in many different forms and is not limited to learning the content or subject under study.

I continue to be interested in examining evaluation questions related to learning from two perspectives: What did participants learn about the subject/topic/content that was discussed? and What did they learn about the medium of computer conferencing and its influence on the learning process? One method is to analyze the computer transcript because it affords an unobtrusive and fairly accurate means of gauging whether participants learned during the conference. If I look carefully at the transcript, I can decipher unsolicited and/or "thinking aloud" comments that refer to individual learning. Evaluation data on the learner's actual learning experience can also be collected by asking participants directly what they learned, either through open-ended questions in questionnaires, or individual interviews (via e-mail, phone or face-to-face); or asking them to discuss their learning in a separate conference space specially designed for this purpose; or posing online a very general questions such as: What did you think about this computer conferencing experience? The use of qualitative interviews to gather rich data about how the learner construes the whole learning experience is reported in Burge (1994), and Eastmond (1994), while Bullen (1998) used a case study approach with both quantitative and qualitative data to identify the factors most often cited by students as either facilitating or inhibiting their participation and critical thinking in online discussions.

In order to understand the many forms of learning that occur in online courses, I have often asked students to keep weekly journals documenting all aspects of their learning. While these journals have given me a unique perspective of each individual's learning process, their use is not unproblematic: students may be reluctant to self-disclose their actual learning experiences, and Institutional Review Boards (Human Subjects Review Committees) may be concerned about violating student privacy issues. Other techniques include asking students to critique their online learning experiences and to apply and transfer what they have learned from the online conference to developing a new online conferencing design. I have learned

that qualitative approaches work better than quantitative methods in being able to understand how individual students think they learn.

How is knowledge constructed in social negotiation?

This question is grounded in social constructivist theory which posits that knowledge is constructed through social interaction and collaboration with others (Vygotsky,1978). To address this question, I believe that we must engage in the challenging task of content analysis or interaction analysis of computer transcripts using qualitative research techniques. I have relied earlier on interaction analysis to find an answer to this question, and our efforts led ultimately to the development of an interaction analysis model for examining social construction of knowledge in online learning networks (Gunawardena, Lowe, and Anderson, 1997). The development of the interaction analysis model began when we started analyzing the transcripts of a global online debate we had conducted as an adult professional development experience involving fifty four voluntary online participants, either practicing professionals or graduate students in distance education representing several countries. We started with the question: Was knowledge constructed within the group by means of the exchanges among participants? and chose Henri's (1992) interaction analysis model as the most promising starting point. It soon became clear that three aspects of Henri's model; its basis in a teacher-centered instructional paradigm, its distinction between the cognitive and the metacognitive dimensions, and its treatment of the concept of interaction, were unsuited for application to the debate. We felt that we needed to develop a new definition of interaction for the CMC context if we are to examine the process of social negotiation.

We believe that the metaphor of a patchwork quilt better describes the process of shared construction of knowledge that occurs in a constructivist learning environment. A quilt block is built up by the application, one after another, of small pieces of cloth, which when assembled form a bright and colorful pattern. The pieces represent individual contributions, each one showing its own texture and color of thought, just as every scrap of fabric forms a distinctive element in the overall pattern. The pattern may not be complete during a single conference, but individual responses can contribute toward the formation of a pattern. The process by which the contributions are fitted together is interaction, broadly understood, and the pattern which emerges at the end, when the entire gestalt of accumulated interaction is viewed, is the

newly-created knowledge or meaning. Interaction is the essential process of joining the pieces in the co-creation of knowledge.

Based on our new definition of interaction, and on grounded theory data analysis, we developed a framework of interaction analysis appropriate for analyzing a constructivist learning experience. It was analyzed for the type of cognitive activity performed by participants (questioning, clarifying, negotiating, synthesizing, etc.), the types of arguments advanced throughout the debate, the resources brought in by participants to explore and negotiate new meanings, and the evidence of changes in knowledge development as a result of interactions within the group. Using these four analysis foci, we developed an outline of the process of negotiation which appears to occur in the co-construction of knowledge. The outline led to the development of a five phase model of the negotiation process. The phases of learning occur at both the individual and social level and can be described as: sharing/comparing; dissonance; negotiation/co-construction; testing tentative constructions; and statement /application of newly-constructed knowledge. Our article gives more detail about the development of the model, its underlying theoretical framework and its application to the analysis of the debate. The efficacy of this model was tested in other evaluations of online learning, at the University of Alberta in Canada by Kanuka and Anderson (1998), and at the Monterrey Tech Virtual University in Mexico, by Lopez-Islas, Megchun-Alpizar, and Ramirez-Angel (2000). We feel that our model serves as a useful initial framework for analyzing the process of learning in online interactions, however, further research is needed to fully understand the dynamics of the social construction of knowledge.

Final words

I would like to end this reflection about evaluation methods for online learning and teaching with my list of key issues and questions we still face, and the best guidelines I can offer my colleagues as they plan for evaluation of online activity. If we are developing innovative designs for teaching and learning through online networks, then, one of the key issues we need to examine in future evaluations is the "process" of online learning. For example, how is knowledge constructed through the process of collaboration and social negotiation? What is the nature of this socially shared cognition? Another issue is

the need to examine the relational or social nature of online networks and then determine how this feature influences the online learning process. As we expand online learning to include diverse populations in cross-cultural and international settings, we need to understand cultural influences that impact motivation, approaches to learning, thought patterns, interaction, and group dynamics. Another issue is the need to understand online learning and teaching as a dynamic system, which includes several component parts each pulling, tugging, and influencing each other. These issues require in-depth understanding of the dynamics of online learning networks.

The best suggestion I can offer as you approach online evaluation is to maintain an open and inquiring mind. Do not approach the evaluation task with pre-conceived notions about the advantages of one method over another. What is crucial is that you ask the important questions and define them clearly, and select a combination of methods to answer them. I have found that the adoption of a single technique for analyzing the quality of the learning experience in online learning networks has not yielded satisfactory answers. The complex nature of online learning calls for the use of multiple methods and multiple sources of data to understand group as well as individual learning. In this chapter I have attempted to discuss the range of questions I have asked and the variety of methods I have used in my online evaluation efforts. My future evaluation activities will move me on to different questions and different methods, and the adoption and development of new models in order to understand the complex and dynamic nature of online learning and teaching.

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