Developing and Implementing eAssessment Strategies in Virtual Learning Environments

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Abstract

eLearning collaborative pedagogy assumes that interaction is important for successful courses, yet questions exist regarding the nature and extent of the interaction and its effects on student performance. Although the majority of past studies focus on students' perceptions of the quality and quantity of their interactions and the benefits they gained in e-learning, no research has examined the impact of online student participation on their performance. This study fills in this gap by proposing and testing a model for examining the relationship between online performance and students' type/level of participation in online forums. Findings provide suggestions for developing effective e-learning.

1.   Introduction

E-learning environments enable students to engage with tutors and peers in ways that previously may have been impossible. Although e-learning is widely being adopted for enhancing and complementing tourism and hospitality instruction (Sigala & Christou, 2002) and its advantages for tourism and hospitality education are extensively argued (Cho, Schmelzer & McMahon, 2002; McDonnell, 2000; Williams & McKercher, 2001), little is known regarding the types of interaction/means by which students create new knowledge in e-learning. Pedagogical theories used for e-learning assume that interaction is important for successful courses, yet questions exist regarding the nature and extent of the interaction and its effects on students' performance. However, past studies assessing e-learning platforms and benefits have mainly focused on examining students' perceptions and beliefs (Sigala, 2002b; Curtis & Lawson, 2001).

This paper contributes to the literature by developing and testing a way for evaluating students' participation in collaborative online forums and examining the relationship of the latter with students' performance. The tools used for evaluation was based on Gunawardena, Lowe & Anderson's (1997) model for analyzing the content of discussion transcripts. This approach was found to provide a useful conceptual lens for coming to an understanding of the e-learning processes. The model is applied in real online student forums developed to enhance classroom-based instruction. Findings provide useful suggestions for developing successful e-learning.

2.   eLearning Pedagogy and the Importance of Interactions

Internet's capabilities imply a different type of thinking in terms of how to make full use of its learning-enhancing features and pedagogical potential. Internet's affordance for enhanced communication provides great opportunities for combining collaborative techniques with technology to dramatically enhance the learning process and outcomes (Salmon, 2002; Sigala, 2002a; Cho et al, 2002). Harasim (2000) also advocated that the asynchronous, hypertext and multimedia based nature of the technology represents cognitive advantages (e.g. flexibility of the nature of interaction, reflection on stored communication or reduction of discriminatory communication patterns based on physical features and social clues) that provide an augmented domain for collaborative learning. The electronic implementation of collaborative learning often results in the development of virtual classrooms whereby tools such as electronic bulletin boards, mail, grade books, quizzes and lectures are used to provide feedback, distribute material and develop learning communities (Sigala, 2002a; Cho & Schmelzer, 2000; Williams, 2001). Overall, e-learning platforms are increasingly adapting a pedagogical approach that is based on the theoretical underpinnings of constructivism (critical thinking skills) and collaboratism.

Constructivism argues that knowledge is created by searching for complexity and ambiguity, looking for and making connections among aspects of a situation and speculation (King, 1994). So, when learners are exposed to new information, each learner evaluates and analyses it, sees the relationships between the new information and his/her existing knowledge and makes inferences and judgments for new knowledge (Kafai & Resnick, 1996). So, to enhance learning, students should think critically, have the ability of analyzing situations, search for evidence and seek links between a specific situation and their prior knowledge and experience (Sigala, 2002a).

Collaborative learning evolved from the work of psychologists (e.g. Johnson & Johnson, 1975) and involves social (interpersonal) processes by which a small group of students work together to complete a task designed to promote learning. Thus, collaborative learning involves the creation and interpretation of communications among persons/groups that might have different understandings and opinions (Goodwin & Heritage, 1995), which in turn enhance learning by allowing individuals to exercise, verify, solidify, and improve their mental models. Dillenbourg & Schneider (1995) identified three collaborative learning mechanisms directly affecting cognitive processes: a) conflict/disagreement; conflict forces learners to seek information and find a solution; b) internalization of interactions with more knowledgeable peers; c) self-explanation; less knowledgeable learners learn from explanations from more advanced peers, but the latter also benefit from constructing explanations (self-explanation effect). In collaborative learning, group processes are a part of the individual learning activity – individual and collective activities are mutually dependent on each other. This is because the learner actively constructs knowledge by formulating ideas into words, and these ideas are built upon through reactions and responses of peers (Johnson & Johnson, 2000). In other words, individual learning is a result of group processes, learning is not only active but also interactive and so, collaborativism is also seen as a variation of constructivism that stresses the cooperative efforts among students and instructors.

Collaborative e-learning was found to significantly foster motivation and enhance the development of communication, interpersonal, social, cognitive and metacognitive skills and competencies (McConnell, 1994; Campos, Laferriere & Harasim, 2001; Johnson & Johnson, 2000). In tourism and hospitality education, such skills and competencies are vitally important (Christou, 1999) as graduates must work, communicate and collaborate (online & offline) within multi-cultural, multi-lingual and geographically dispersed environments (Sigala, 2002a; Cho & Schmelzer, 2000; Christou & Eaton, 2000). Thus,

the applicability and value of online constructivism-collaborative approaches for tourism and hospitality education are clearly apparent.

3. Evaluating Online Interactions

With increasing interest in the evaluation of e-learning and online discussion groups, researchers have been applying a number of tools to tease out key aspects of the interaction that can lead to improvements in online learning environments (Pitman, Gosper & Rich, 1999). The evaluation of online discussion probably most often occurs as part of the routine module evaluation, with various methods used to determine students' perceptions of the experience such as surveys, interviews and focus groups. However, the unique features of the online forums invite for other approaches to evaluation. One could measure students' level of participation in a forum based on statistics on the number of users, frequency of access, number of messages per student, number of threads/messages per thread (Harasim, 1989). Yet, while this data can be useful, there is a danger in implying that level of online participation reflects level of learning (Mason, 1992).

On the other hand, the transparency of online discussions, the fact that all communication is easily organized stored and retrieved, suggests that analyses of the text-based archives/transcripts provides a powerful tool to understanding and evaluating e-learning. Although various authors have developed models to facilitate this analysis, there are as yet few studies in which these tools have been applied to real situations. McKenzie & Murphy (2000) noted that this reluctance may be due to not only the time and labor-intensiveness of this task but also to the lack of availability of tested models for assessing online forums' effectiveness using transcripts.

Of the proposed models, the preferred method of analysis varies according to the purpose of the evaluation and the interests of the researchers. In examining the nature of the interaction among participants, Levin, Kim, & Riel (1990) proposed a quantitative approach by constructing "message maps" that represent the flow of communication within the group, but ignore messages' content. Levin et al (1990) used this analysis to identify threads and display the multithread nature of the interactions. They observed that some messages were particularly influential in producing numerous or lengthy sequences of responses, but message maps also formed confusing structures of threaded message archives as students built on previous contributions. So, message maps are only valued in viewing the interrelationships of various messages.

Other researchers are primarily interested in evaluating the effectiveness of online discussion in terms of the learning process. Each takes a similar approach to analyzing the discussion record, by first breaking the transcript down into small units and then classifying these units according to the content. Sometimes the categories are defined retrospectively capturing the flavor of a particular forum (e.g. McLoughlin, 2002; Mowrer, 1996). Other researchers take a more theoretical perspective, by designing the categories a priori to reflect evidence about the learning process in which the participants are engaged. Indeed, it is this level of analysis that is needed to evaluate and guide the use of online discussion environments. In Henri's (1992) model the transcripts are analyzed on five dimensions: participative; interactive; social; cognitive; metacognitive. Her approach is grounded in a cognitive view of learning, focusing on the level of knowledge and skills evident in learners' communications, and has been used in comparing critical thinking skills in online forums (McKenzie & Murphy, 2000; Curtis & Lawson, 2001).

Although Henri's (1992) approach provides a sophisticated framework for cognitive analysis, shortcomings have been identified. Henri's model is based on a tutor-centered instructional paradigm that is inappropriate in a constructivist environment where

learning is based on the shared construction of knowledge (Gunawardena et al, 1997). This is because Henri's analysis of interaction did not reflect the "gestalt' of the entire online discussion, but rather focused on links between specific messages. A gestaltist approach to analyzing the interaction of the entire online conference was central to Gunawardena et al's (1997) purpose to evaluate evidence for the social construction of knowledge. Their own preferred method of content analysis was developed to capture the progression of ideas as they were reflected at different phases of the debate:

- sharing/comparing information; this phase may include an observation, opinion, agreement, corroborating example, clarification and/or identification of a problem.

- discovery and exploration of dissonance or inconsistency among the ideas/concepts or statements advanced by other participants; this is defined as an inconsistency between a new observation and the learners' existing knowledge and thinking skills, e.g. identification of differences of terms/concepts/schema and/or questions to clarify the extent of disagreement.

- negotiating meaning and co-construction of knowledge; e.g. negotiation/clarification of the meaning of terms, detection of areas of agreement, proposal of a compromise/co-construction

- testing and modification of proposed synthesis; testing against an existing cognitive schema, personal experience, formal data experimentation, contradictory data from the literature.

- agreement, statements and application of newly constructed meaning; including summarizing agreements/metacognitive statements showing new knowledge construction and application.

Overall, their proposed constructivist model of content analysis theorized that the interactive construction of knowledge moves through five phases and that although every instance of socially constructed knowledge may not progress linearly through each successive phase, they are nonetheless consistent with the literature related to constructivist knowledge creation.

4.   Research Aims and Methodology

The study aimed to evaluate students' participation in collaborative online forums and examine the relationship of the latter with students' performance. After reviewing the literature, the study adopted Gunawardena et al's (1997) model for investigating students' type and level of participation in online forums, because: the model was consistent with the constructivism/ collaborative approaches adopted in the online forum that was examined; it reliably represented and identified the learning processes in which, according to the literature, students should engaged for gaining the e-learning benefits and achieving increased performance. Thus, the following research questions were formulated and tested: to what extent the Gunawardena et al's components of e-learning can be identified in the online interactions of students?; are the type and level of students' interactions (i.e. participation in e-learning processes) related to their performance?.

The research methodology proceeds in four major steps: unitizing, coding, reliability tests and analysis. Using a hard and digital copy of the transcript from the online discussion forum, each message was first coded using unique identifiers for all student contributors (other postings such as moderators' feedback/threads/general announcements were excluded from the analysis). Each message was then divided into "message units".

Krippendorf (1980) described the unit of analysis as a discrete element of text that is observed, recorded, and thereafter considered data. Many units have been experimented in e-learning (Rourke, Anderson, Garrison & Archer, 2001). However, none has been sufficiently reliable, valid and efficient to achieve preeminence. Syntactical units (e.g. sentence/paragraph) allow for consistent identification, but they are artificial and arbitrary designations that abide by logic that is usually external to the logic of the indicators of interest. An alternative is the "thematic unit", defined as *"a single thought unit or idea unit that conveys a single item of information extracted from a segment of content"* (Budd & Donohue, 1967: 34). Thematic units such as meaning units (Henri, 1992; McDonald, 1998) should reflect the logic of indicators, but they resist reliable and consistent identification (Howell-Richardson & Mellar, 1996; Rourke et al., 2001). The most appropriate unit would combine the flexibility of the thematic unit, which allows coders to capture a unit in its natural form, with reliable identification attributes of a syntactical unit. Thus, working definition of a "message unit" was adopted referring to that representing one "idea". It was found that message units mostly corresponded to paragraphs, as this is how people tend to organize written communication (Henri, 1992).

Gunawardena et al's phases/processes were then used for classifying/coding each message unit. This approach yields both quantitative and qualitative data, as units are associated with input processes of each student. Specifically, the number of message units per category and per group was calculated for analyzing the level and type of students' interactions/participation in online forums. The former were then related with online performance for examining the relationship of student participation with e-learning performance. Reliability tests of the interactions' content analysis were also conducted. This involved two reproducibility tests: a two-coder (two data analysts perform content analysis on the same data independently using the same coding rules); a two-sets of message units. The two-coders analyses were compared and the coefficient of agreement was calculated at 85%. After discussion and reference back to the transcripts most inter-researcher were removed as suggested by Krippendorf (1980). Moreover, acceptable percent agreement interrater reliability figures ranging from 0.90 on first coding to 0.95 on second application to a new set of transcripts were also achieved.

5.   Describing the Examined Virtual Learning Environment

Primary data for answering the research questions were collected from students participating in an online forum that the lecturer/researcher developed to support and enhance the classroom-based instruction of a module. The online forum was an effective tool for enhancing classroom-based teaching because: the class was very large to enable dialogue among students; staff and time requirements (students had varied university and work timetables) constrained the ability to organize tutorials with smaller student groups; teaching was provided overseas in a block week, and so, tutorials during the semester were impossible. So, online forums were created aiming to: allow students to exchange ideas among themselves and with the lecturer asynchronously (through e-mail) and synchronously (e.g. chat room sessions); and create a data centre to store, update and access teaching and learning material of the modules in a secure environment (lecture notes/presentations, working papers/reports, bookmarks).

The yahoo! service (http://groups.yahoo.com/) was used for creating online forums that had: 1) a message area; group members can receive/send e-mails through their e-mails, send and access/retrieve any message sent to the group by using the Webmail; 2) file area; an area whereby teaching and learning material can be stored, accessed/downloaded by any group member. A directory structure was developed to make navigation/search easier; 3) bookmark area; bookmarks of relevant material, e-journals, associations,

research centers etc, were stored in a specific location, because that was the area that was updated more regularly; 4) other features including chat sessions, polls, members' area (profile, interests) and calendar were available and students were motivated to use them. Yahoo! groups were used because of their familiarity/popularity among students and the previous evidence of their good performance in e-learning (Joia, 2002). The online forum involved the accomplishment of a group task (Salmon, 2002) that was linked to the modules' coursework (an individual assignment) to motivate participation and weekly monitored/moderated by students and the lecturer via summary reports and formative feedback respectively (Table 1).

Table 1: Online Forum Activities

Module	Online group task
	Conduct a debate with affirmative and negative ideas, with the instructor as the facilitator.
	Group task guidelines and requirements
	The tasks, concepts and online forum were explained, introduced and shown in class-room instruction.
	9 weeks were available for online debate. One (different) student had to summarise online arguments every week and e-mail a summary to the tutor and the group (in order to diagnose problems, facilitate/moderate discussions, provide formative assessment/feedback). Group summaries were uploaded in the file area of the group for online access. The weekly task for each group was to read and respond to the arguments made by the groups debating the opposite argument to theirs. One student had to write a final report summarising the whole debate presented by his/her team and submit it to the tutor in week 10. The module assignment (submitted in week 12) was an essay that had a similar topic to the online debate. At any time, students could retrieve any message posted by any team member through the Webmail. This allowed students to build and develop stronger arguments, exchange resources etc.
Tourist Service Management (3rd year, BA) (151 students, 15 yahoo! groups)	Students were grouped into groups of 10 (approximately). Each group had to debate one of the following issues: ▪ Information & Communication Technologies applications have a negative impact on service quality in hotel guests-staff encounters. ▪ Information & Communication Technologies applications have a positive impact on service quality in hotel guests-staff encounters.

6. Analysis and Discussion of Findings

6.1 Level and Type of Online Student Participation

From 975 messages, 1,672 message units were defined. On average, messages contained 1.7 units, each unit being approximately eight lines (or 65-80 words). The average number of messages per group was 62. Out of 151 students, 128 posted at least one message, 53 of which posted more than 10 messages. Overall, 61 students accounted for 80% of total number of messages. Regarding the type of contributions (Table 2), it was found that a great majority of message units reflected inputs regarding "sharing/comparing of information" and "discovery/exploration of dissonance/inconsistencies (38% and 23% respectively). The remaining phases attracted fewer message units, with the last phase attracting the least (12%). Table 3 provides some examples of how students' online contributions were classified within each category according to Gunawardena et al's (1997) model. Moreover, it was also found that 53 (the 53% of) students accounted for the 80% of the message units coded in the last three phases.

The analysis of participation levels indicated that the discussion forum was used by a core group of students who contributed regularly. Student participation may have been

increased by establishing more explicit links between module assessment and forum performance (Salmon, 2002). This distribution of message units and specifically the overwhelming number of message units in the first phase also raised the question of students' skills and motivation to engage in online collaborative tasks (Sigala, 2002a). A number of possible hypotheses can be generated theorizing why the vast majority of interaction was at the first level. Previous findings (Sigala, 2002b) revealed that students were limited in their communication ability due to language barriers and the limitations of a text-only environment and a low social presence. An alternative hypothesis explaining the absence of negotiation of meaning is that it is much easier to ignore or not to respond to online messages that are incompatible with existing knowledge than it is in face-to-face environment (Kanuka & Anderson, 1998). The lack of or limited participation by some students may also be due to technical difficulties and/or due to some students finding hard to keep pace with the discussions as the forum run simultaneously with other modules during the semester. Students' feedback on their experience and use would have yielded more useful and reliable results regarding the reasons of their observed type and level of participation and appropriate correction actions. Thus, the importance of continuous student feedback is highlighted.

Table 2: *Level / Type of Participation: Its Impact on Performance (* significant P correlations, α =0.001)*

Learning processes/phases	Percentage of message units Overall analysis		Pearson correlations Essay grade – individual forum participation	Pearson correlations Essay grade – group forum participation
	N	%		
Sharing/comparing of information	636	38%	0.368	0.429
Discovery/exploration of dissonance/inconsistencies	385	23%	0.461	0.591 *
Negotiation of meaning and co-construction	184	11%	0.601 *	0.693 *
Testing/modification	266	16%	0.482	0.568 *
Phrasing of agreement of newly constructed meaning	201	12%	0.247	0.468
Total	1,672	100%	0.402	0.613*

Table 3: *Summary of the Classifications Used in the Transcript Analysis to Measure Student Interaction Based on Gunawardena et al's (1997) Model.*

Learning processes/phases	Examples of students' contributions
Sharing/comparing of information	"Hi everybody. I just found this reference X and thought of sharing with you. I quickly read it through and it seems to be in line with our previous discussion regarding the impact of CRM on customer service." "Last year, I booked a room at Travel In through expedia.com, but then had to cancel it as my flight was canceled. As I had no Internet access at the airport and I called the property. The staff found my internet reservation immediately and canceled that, so I also believe that integration between ICT applications can significantly impact on customer service".
Discovery/exploration of dissonance/inconsistencies	"I do not think X made a valid point. Although he had a bad experience when trying to make a booking on the Internet, there is plenty of research that illustrates how well designed websites can make reservations more effective and customer friendly". "I was thinking the same way. Websites should be designed and structured in good way if customer service online is to be increased".
Negotiation of meaning and co-construction	"I really like your interpretation of Zuboff's theory. From my experience in while working in hotel X …". "I think X made a valid point regarding the self-service check-in kiosks. However, in Zeithmal's paper self-service is not always positively perceived".
Testing/modification	"In X message, I just don't understand his point. Is it the case that does the theory say that personalized technologies always increase customer service? From my own experience, I received an e-mail from amazon.com which I found very intruding…". "It also happened to me. When I was once checking in a hotel, the receptionist ask the gentleman in front of me whether he wanted the playboy delivered to his hotel room as the last time he stayed in the hotel. I am sure that man was not happy about this personalized customer service as next to him was his wife."
Phrasing of agreement of newly constructed meaning	"Hello, guys, just to propose a solution to this on going argument. Shall we just agree that bad designed website can significantly decrease customer service, while well designed website can significantly increase it? In this case, we accept that website design is a crucial moderator factor of service quality". "Guys, I think that you are forgetting something that we discussed in class last week. Do you remember the concept of permission marketing? I think your arguments illustrate that the effectiveness of personalized customer service should be considered along with privacy issues, in which case we might be talking about privately and individualized defined and measured customer service"

However, it may also be possible that the construction of knowledge is not an observable activity. For example, students may have been reflecting on the issues presented in the forum, resulting in the construction of knowledge that was not shared with other participants. Or perhaps knowledge construction occurred over time, after the forum closed. It must be acknowledged, then, that transcript analysis provides only an indicator of the knowledge construction process and is based on the assumption that knowledge construction is an online observable process. To better investigate the impact of forum on student learning performance, an analysis of the impact of the type and level of participation on student performance was conducted.

6.2 *Investigating the Relation between Online Student Participation and Performance*

The module coursework entailed an individual essay based on the topic debated on the online forum in order to foster and motivate student participation in the forum. As the coursework was directly linked with the forum, for examining the impact of the forum on student learning performance and knowledge construction, students' essay grades were correlated (Pearson two tailed correlation) with students' forum participation. Specifically, two types of Pearson correlation were conducted: a) individual grades were correlated with individual level of participation for studying the impact of individual inputs on performance; b) individual grades were correlated with group level of participation for studying the impact of group overall inputs on student performance. The latter analysis was conducted because constructivism-collaborative theory theorizes that students can also learn by reading, reflecting on and internalizing peers' contributions.

Correlation coefficients between essay grade and forum participation were significant when group total level rather than individual total level of participation was considered (Table 2). Thus, results indicated that essay grade and so, student performance is significantly affected by the level of group and not individual participation, meaning that student participation in constructivism-collaborative learning environments does have an impact on learning performance. Indeed, when looking at the impact of particular types of participation, the correlation coefficients were lower (and not significant) in the case of individual than group participation. Actually, when individual participation was considered, only message units related to the phase reflecting negotiation of meaning/co-construction were significantly correlated with essay grade, meaning that students seriously engaged with and reflecting on the online debate achieved higher grades. Three higher phases of group participation (discovery/exploration of inconsistencies, negotiation/co-construction, testing/modification) were also significantly related with grades.

7. Conclusions and Recommendations

Although successful online instruction is assumed to be vitally dependant on student interactions, questions still exist regarding the impact of the latter on performance. To overcome limitations of past studies focusing only on students' perceptions, this paper examined this issue by testing Gunawardena et al's (1997) model for evaluating student online participation and investigating its impact on student performance. Primary data were gathered from students participating in online forums developed to support classroom instruction. Findings revealed unequal and uneven distributed student interactions that focused on lower phases of interactions and on the inputs of few students. Although this can be attributed to several reasons, student feedback was suggested as an effective way for identifying appropriate correction actions. Tests also revealed that it was the level of group than individual participation as well as interactions of higher than lower phases that significantly impacted performance. These findings imply that: students should be assisted in becoming motivated, skilled and active members of online communities that can contribute to learning processes; individual level of participation does not entail low performance. Students also learn by reading interactions (passive participation) as being in classrooms.

However, the assessment of online lurkers is an interesting issue that needs consideration. Although passive participation may not entail that students do not learn and so, should not penalized in grading, the latter may not be fair for students that do participate. In this vein, Guwardenama's model can have a dual role: used for rewarding students based on

the quality of their online performance; a diagnostic, formative type of assessment that can identify students that cannot or do not want to contribute so that corrective action can be taken well in advance.

 As performance was measured only by students' grades, future research could assess whether the communication, social, interpersonal and technology skills that e-learning can enhance are actually achieved as well as to investigate the factors that may moderate/facilitate their achievement. Moreover, there is also another way that future research can enhance this study. Specifically, the effectiveness of e-learning can also be tested and validated through the use of a control group. In this vein, future research studies can focus on detecting whether the performance of students studying through e-learning environments is better or worse from students studying through traditional methods (control group). The replication of the study in different contextual and learner environments could also further refine, develop and enhance current findings. Of particular interest and importance is the identification of any specific factors related to learners' cultural and/or learning disabilities that could impact on e-learning and the investigation of effective ways for addressing them. Future studies could also extend and expand the current study by investigating and examining the learning impact of tutors' participation in online forum as well as of other contextual and student factors such as students performance overall and their learning styles, interaction between subgroups and students outside e-learning platforms. Studies focusing on the isolation and measurement of the impact on learning effectiveness of these factors can significantly contribute to the body of knowledge by identifying strategies in which tutors can facilitate and support online discussions as well as ways for designing effective e-learning platforms.

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