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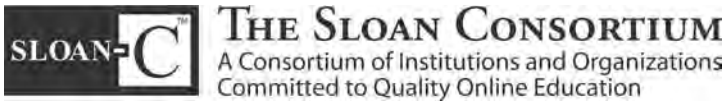

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COURSE ASSESSMENT PRACTICES AND STUDENT LEARNING STRATEGIES IN ONLINE COURSES

Bridget D. Arend, Ph.D.
University of Denver

ABSTRACT

Perhaps the most promising and understudied aspect of online education is course assessment. Course assessment is important because it has a strong impact on learning and is an indicator of the quality of learning occurring in a class. In the online environment, methods of assessment can be very different. However, the online education literature is currently lacking empirical data about the general status of assessment practices or how those practices relate to student learning. This article lays the groundwork for future studies by providing a description of formative and summative assessment and learning strategies in 60 online courses and suggesting some ways that assessment practices lead to different types of learning. In this study, instructors appear to follow effective practice by using multiple and alternative assessment methods, dispersing grades over time, and providing timely and frequent feedback to students. Students report focusing on relatively more complex learning strategies, such as elaboration and critical thinking over rehearsal. However, online instructors need to ensure that assessments are used strategically and that feedback is productive and able to be acted upon by students.

KEYWORDS

Course Assessment, Summative Assessment, Formative Assessment, Learning Strategies, Critical Thinking

I. INTRODUCTION

In the online environment, the lack of physical space and face-to-face contact between instructors and students leads to different ways of assessing learning in a class. Online, the instructor cannot tell whether the student is in attendance unless he or she is actively contributing something to the virtual class. As a result, online instructors grade for participation, typically assigning between 10 and 25% of the course grade for discussions participation [1]. To prevent dishonesty as well as to create a learner-centered environment, students are typically awarded grades based on a variety of assignments, quizzes, papers, tests, group projects, and discussion contributions [2]. Grading also occurs throughout a class, rather than at one or two points in a term. This increased emphasis on continual and alternative assessment methods has great potential to increase the transparency of the learning process and improve learning.

Classroom assessment is important because it has a strong impact on learning. The way an instructor approaches assessment influences the way students perceive the class, the material for study, and their own work [3]. Most importantly, assessment practices influence students by directing their attention to particular aspects of course content and by specifying ways of processing information [4]. Students concentrate their efforts towards whatever content or cognitive skills they believe will be tested [5, 6]. So not only does assessment influence what content students spend time learning, but also the type of learning occurring. Different forms of assessment encourage different types of learning [7, 8, 9]. Even the

form of an exam or essay question can affect how students study [10]. In the online environment specifically, it has already been shown that the nature of online discussion questions [11], or the emphasis on grading criteria [12], can influence the type and quality of online discussion responses.

One way of exploring the type and quality of student learning is through the cognitive processes students use to study, called learning strategies. Learning strategies are the specific cognitive activities and thought processes that students undertake when studying for a class, such as underlining text, making an outline, or applying knowledge to a new situation. They have been defined broadly as cognitive processes that are intentional and under control of the learner [13]. They have also been referred to as surface or deep approaches to learning [14, 15, 16].

Numerous studies have explored and supported the link between the assessment practices in a course and the learning strategies students use in a course [17, 18, 19, 20]. Studies have illustrated not only how different assessment methods encourage different learning strategies, but how different learning strategies result in qualitatively different learning outcomes. For example, students who read text at a deep level are better able to answer questions about the meaning and conclusions of the text, while surface strategies result in mainly descriptive answers [14]. Simple methods used to study for objective tests are not as effective for long-term retention as more complex methods used to study for essay tests [9]. And surface approaches are found to be effective for recalling detail whereas deep approaches are effective for the development of more complex and meaningful knowledge structures [8, 16]. In general, when students focus on more complex cognitive and metacognitive processes over routine rehearsal processes, they are more academically successful [21, 22]. The learning strategies students use in a course ultimately influence their overall learning outcomes.

Thus, a framework emerges whereby assessment practices are very important in determining the type of learning taking place in a course. The type of learning is an indicator of the quality of learning, and online learning environments by their very nature lend themselves to new and different assessment practices. Clearly there is a need to explore assessment practices and learning in the online environment. However, little literature exists about online assessment practices [6, 23, 24, 25]. It has been noted that most of the literature about online assessment is in the form of guidelines and case studies or explores a specific assessment practice within one or a small number of classes [26]. Only a few studies have taken a broad look across disciplines at the typical assessment practices that are occurring in online courses in higher education, but most have not explored how these new assessment practices influence the learning strategies of students [27, 28]. To respond to increased calls for accountability and to support emerging exploration in this area, more empirical data is needed about the status of online assessment. This study was designed to fill this gap in the literature and contribute to an understanding of what assessment looks like online and how assessment influences learning.

The purpose of this study was to describe how course assessment practices relate to learning strategies for students taking an online course at the community college level. This involved describing the status of assessment practices in terms of summative and formative assessment, describing the use of student learning strategies, and exploring which course assessment practices are related to which learning strategies. The summative and formative assessment and learning strategy variables used in this study, as well as their origins, will be described next.

A. Summative and Formative Assessment

Just as learning is a complex process with many variables involved, course assessment is complex and involves many aspects and dimensions. Course assessment is typically theorized in terms of summative

and formative assessment. The theoretical difference between the two is a matter of purpose whereby summative assessment is designed to make evaluative judgments of student learning and formative assessment focuses on using feedback and information to improve learning [29]. Assessment scholars agree that most of the literature about summative assessment in higher education focuses on issues of broader accountability rather than the learning that occurs within the classroom [30, 31]. Perhaps the best source of identifying effective summative practice grounded in literature comes from the former American Association for Higher Education (AAHE). In 1992, AAHE pulled its best minds together to create nine well-supported Principles of Good Practice for Assessing Student Learning. Although the AAHE principles also focus on the program and institutional level, they are useful for understanding assessment within the classroom. The principle that is most encompassing and most useful for classroom learning is AAHE principle #2: "Assessment is most effective when it reflects an understanding of learning as multidimensional, integrated, and revealed in performance over time" [32]. Angelo [33] describes this principle in more depth by dividing it into four complementary components: use multiple methods; use multiple assessors; assess over time; and assess multiple dimensions of learning. Each of these four components has its own basis in assessment literature. It is these four aspects of effective practice in summative assessment that form the variables used in this study to describe summative assessment.

In contrast to the evaluative objectives of summative assessment, formative assessment is used for purposes other than making evaluations and recording course grades. Even though formative assessment is discussed and studied more than summative assessment, it is also a concept without a widely accepted meaning or overarching formal theory [34]. It has been broadly defined as including all feedback and information used to modify teaching and learning activities [35]. Most of the categorizations of formative assessment focus on the procedural aspect of feedback occurring between instructors and students. The process of effective feedback is often described as a loop whereby feedback is given and acted upon by both instructors and students [34]. Four general dimensions of effective feedback that emerge from the literature include: instructors providing frequent feedback, instructors providing precise feedback, instructors changing course content or teaching methods based on student feedback, and students actually acting on instructor feedback [5, 34, 36, 37]. These four dimensions provide a description of effective practice and were used as the formative assessment variables in this study.

B. Learning Strategies

The learning strategy taxonomy used in this study was developed by the National Center for Research in Postsecondary Teaching and Learning (NCRIPTAL) at the University of Michigan [9]. The taxonomy includes five cognitive and metacognitive learning strategies: rehearsal, elaboration, organizational, critical thinking, and metacognitive self-regulation. Each strategy is represented by various study activities or cognitive processes. For example, rehearsal strategies assist the attention and encoding process and include such tasks as memorizing, reciting items from a list, copying material, or underlining passages. In the past, rehearsal strategies were found to be those most frequently used by college students [21]. Although this taxonomy is not based on a continuum, in this study rehearsal strategies are considered the most basic type of learning strategy, representing the surface approaches to learning. The other learning strategies are considered generally more complex learning strategies. Elaboration strategies help students store information into long-term memory by building internal connections and include using imagery, identifying key words, paraphrasing, and creating analogies. Organizational strategies help the learner select appropriate information and construct connections within the information to be learned. Examples are clustering, creating mnemonics, and selecting main ideas such as outlining or diagramming. Critical thinking strategies help students develop new ways of thinking about course content such as applying prior knowledge to new situations, transferring knowledge, reaching decisions, and making evaluations. Finally, metacognitive self-regulation strategies identify how students control and modify

their cognitive processes. These planning, regulating, and monitoring strategies include such tasks as setting goals, self-testing, regulating the speed of reading, and using test-taking strategies. These five learning strategies are used in this study to describe the type of learning occurring online and to determine any relationships that exist between assessment practices and learning.

II. METHODOLOGY

A. Participants

The site for this study was the Colorado Community Colleges Online (CCCOnline), an online entity comprised of thirteen member colleges in the Colorado Community College system, Dawson Community College of Montana, Northwest Missouri State University, and Pickens Tech of Denver. This institution offers over 300 educational and occupational online courses to nearly 5000 students each semester [38]. Like other online institutions, CCCOnline enrollments have grown tremendously since its inception in 1999. This institution was chosen as the sampling frame of this study because of its large enrollment, variety of disciplines represented, experience in offering online courses, and diverse representation of instructors and students across Colorado. It was felt that this institution represents a fairly typical online experience for community college students, useful for the descriptive purposes of this study.

Sixty courses were randomly selected from the Spring 2005 semester, stratified by academic program. The academic programs included Accounting, Arts and Humanities, Business and Economics, Computer Information Systems, Criminal Justice, Early Childhood Education, Languages and Literatures, Math, Physical and Environmental Sciences, and Social and Behavioral Sciences. Average course enrollment was 20 students and most of the courses were 100-level (60%) and offered for 3 credit hours (67%). The researcher collected data about assessment practices from each course. Fifty-one instructors completed an instructor survey. These instructors had been teaching college-level courses an average of 13 years and have been teaching online an average of five years. Courses with instructors who were teaching online for the first or second time were excluded from the sample to eliminate any differences due to instructor inexperience. In addition, 411 students completed a student survey. Student participants were mostly female (75%), White non-Hispanic (81%), and U.S. citizens (96%). However, student ages ranged from 18 to 69 and over 80% were employed either part-time or full-time. Almost half had some form of degree or certificate. Most of the students were not only working adults but were comfortable with online technology and were taking classes as part of a degree.

The student response rate was low at 37%. However, comparisons of demographic variables between the study sample and the population of CCCOnline students during the same semester showed that the students responding to the survey were representative of the student population with the one exception that the sample may contain more students with certificates or degrees. In addition, one-way analysis of variance was used to test for response bias among three waves of student respondents. Four of the five learning strategy subscale means on the student survey showed no significant difference between the three student response groups. Only the organization subscale showed potential response bias between the first wave of student respondents and the next two waves, and therefore any results emerging from the organization subscale must be accepted with caution.

B. Instrumentation and Data Collection

Three surveys were pilot tested during the Fall 2004 semester and used in the Spring of 2005 to collect data on formative assessment, summative assessment, and student learning strategies. The researcher was given access to the sampled courses and completed an observational survey to collect information about types of assignments, formative and summative assessment practices, and grading policies. An instructor

survey collected self-reported data about formative assessment feedback practices and dimensions of learning assessed within a course. Both of these surveys were created by the researcher after an extensive literature review to include the salient components of effective practice in summative and formative assessment.

Students were given a survey with 31 items from the Motivated Strategies for Learning Questionnaire (MSLQ) [39]. The MSLQ is widely used to compare student learning strategies to different educational variables. It was designed with subscales that can be used modularly at the course level. The questionnaire asked students to self-report on a scale of 1-7 their frequency of use of rehearsal, elaboration, organization, critical thinking, and metacognitive self-regulation learning strategies. For example, a rehearsal strategy question was, "I make lists of important terms for this course and memorize the lists." The elaboration strategy included such questions as, "I try to apply ideas from course readings in other class activities such as discussions." And a question for the critical thinking strategy subscale was "Whenever I read an assertion or conclusion in this class, I think about possible alternatives." Certain items on the MSLQ were modified to update the wording for the online medium and to measure the frequency with which students report using learning strategies. Reliability coefficients for the revised questionnaire were deemed appropriate. Cronbach's alphas for each subscale were: rehearsal, .745; elaboration, .783; organization, .751; critical thinking, .787; and metacognitive self-regulation, .788. This study also included a follow-up qualitative phase designed to explain and add detail to the quantitative findings, but results are not detailed in this article.

III. RESULTS

A. Summative Assessment

The first goal of this study was to provide a description of the summative and formative assessment practices in the online courses in this sample. Summative assessment was described by detailing four effective practices: using multiple methods, using multiple assessors, assessing over time, and assessing multiple dimensions of learning. n terms of methods, these courses used an average of five different assignment methods. Table 1 lists the methods used and percentage of course grade assigned. The methods used are typical for a college course but also include experiential and alternative methods. Group projects and collaborative activities, methods highly touted in the online assessment literature, were not used at all in this sample. Discussion was the most common method; however exams received the highest percentage of course grades.

Table 1. Assessment Methods Used and Percentage of Course Grade

Method	Courses using this method	Average % of course grade
Discussion	59	17.1
Exam	50	44.7
Written assignment	38	23.5
Final/Midterm	23	19.2
Experiential Assignment	20	18.1
Problem Assignment	19	22.0
Quiz	13	3.5
Paper	13	23.2
Journal	10	15.1

Presentation	6	12.5
Pretest	6	1.0
Project	4	12.8
Peer Review	3	4.6[a]
Form	1	1.0
Group Project	0	--

Note. N = 60.

[a]Peer review grades were part of discussion grade and are estimated based on proportion of discussions.

With regard to the use of multiple assessors, instructors themselves primarily assessed learning. However, self grading was a strong component in these courses. All courses used instructor grading, 65% used a form of self-grading, and only 5% used peer grading. In terms of assessing over time, student learning was assessed throughout a course. Assignments were due an average of 10 out of 15 weeks. However, discussions were usually graded for ongoing participation over all 15 weeks, so students typically needed to actively participate in discussions during each week of the course. The final aspect of summative assessment, assess multiple dimensions of learning, will be discussed below along with student learning strategies.

B. Formative Assessment

The distinction between formative and summative assessment practices, although detailed in theory, becomes blurred in online courses. Because there is no face-to-face class time online, it is difficult to expect students to do assignments unless they are part of the course grade, limiting the use of purely formative assignments. In this study, some formative assessment occurred in the form of non-graded quizzes and exercises. Many of these were supplemental content materials developed by textbook publishers and courses linked to these assignments as a means of giving students extra practice or review. There was an average of seven non-graded assignments in each course, although 30% of the courses did not use them at all.

Formative assessment was primarily described in this study by analyzing student and instructor feedback throughout the course. Feedback was determined from the instructor's perspective using four aspects of effective practice taken from the literature: frequency of feedback, precision of feedback, changes in course or teaching, and student use of feedback. In terms of frequency of feedback, instructors reported interacting and providing feedback to students often and quickly. The vast majority of instructors, 94%, said they had more than 10 individual interactions with each student during the course, 22% claiming more than 40 interactions. Ninety-six percent of instructors also said they responded to students in less than 48 hours, 60% saying their responses came within 24 hours. Instructors also claimed to provide constructive feedback to students regularly. The majority, 86%, claimed to usually or always use student feedback to identify misunderstandings and to give students advice to improve their work. Similarly, regarding precision of feedback, instructors felt strongly that they provide precise feedback to students. Ninety-six percent say they usually or always give students feedback based on a good understanding of their knowledge of the course material, while 91% do so based on a good understanding of their writing and thinking skills.

Instructors reported much lower uses of using feedback from students to change course content or teaching methods. Only 54% said they usually or always modify teaching methods or techniques while

only 40% report regularly modifying or adding course materials. Twenty-three percent usually or always used student feedback to add or change course assignments, and only a few more, 42%, said the same for adding or changing discussion questions. Finally, instructors were asked how often they felt their students actually use the feedback given to them and were somewhat pessimistic about this use of feedback. Only slightly more than half felt that students usually or always used instructor feedback to make any real changes, such as: making revisions to assignments, 55%; seeking meaning from instructor comments, 59%; gaining a better understanding of the course material, 63%; adjusting their learning strategies, 55%; or achieving more advanced thinking and learning processes, 55%.

C. Student Learning Strategies

To provide a description of student learning, students were asked to self-report how often they used different learning activities or cognitive processes that fall under five different learning strategies on a scale of 1 to 7 where 1 = never and 7 = always. Elaboration was the most used learning strategy with a mean score of 4.88, meaning students spent more time elaborating on course material than on other strategies. Metacognitive self-regulation strategies had the next highest use, followed by critical thinking. Students reported using rehearsal and organization strategies the least, averaging just slightly less than half the time (See Table 2).

Table 2. Means and Standard Deviations for Students' Reported Learning Strategy Use and Instructor Goals for Learning Strategy Use

	Student use		Instructor goal	
Learning strategy	*Mean*	*SD*	*Mean*	*SD*
Rehearsal	3.79	1.33	4.90	1.70
Elaboration	4.88	1.10	6.08	1.15
Organization	3.86	1.36	4.96	1.44
Critical thinking	4.29	1.21	5.84	1.34
Metacognitive self-regulation	4.72	0.86	5.63	1.52

Note. N = 411 for student sample. N = 51 for instructor sample.

As a means of determining if these courses assessed multiple dimensions of learning, an aspect of effective practice in summative assessment, instructors were also asked how often their students should be using the five learning strategies in their course using the same language and scale as the student survey. The desired learning goals of these instructors showed similar emphasis to students' reported use. Elaboration was the most desired learning strategy with a mean score of 6.08, meaning instructors wanted students to elaborate on course material nearly always. Critical thinking and metacognitive self-regulation were also relatively strong goals. Rehearsal and organization strategies both appeared to be lesser goals of these instructors. The emphases for both instructors and students were the same, although instructors' desired goals were generally higher than students' reported use for each strategy.

D. Relationship between Assessment Practices and Learning Strategies

This study also sought to explore how summative and formative assessment practices relate to the use of student learning strategies. Most formative assessment variables and general summative assessment variables did not show significant relationships to learning strategy use. Instead, it was the use of individual assessment methods such as discussions or papers that were significantly related to learning strategies. All significant relationships found are displayed in Table 3. No significant findings were found for the rehearsal strategy. Only a few significant findings emerged for the organization and metacognitive

self-regulation strategies and were not deemed notable. A number of variables were found to be significant with the elaboration strategy, indicating that the use of discussions and journals are related to more elaboration strategy use, and the use of pretests, finals/midterms, and non-graded assignments are related to less elaboration strategy use.

Most notably, a comprehensible theme emerged regarding the critical thinking strategy. Discussions, written assignments, and papers were all positively related to the use of critical thinking. Finals/midterms were negatively related to critical thinking use. In addition, non-graded assignments were negatively related to critical thinking as shown in the number of assessors in a course, the number of non-graded assignments, and the number of non-graded methods. There is a pattern that emerges with the critical thinking strategy, although the sizes of the correlations are small. Thus while there are many factors that influence learning strategy use, it appears that the more a course used discussions, written assignments and papers, the more students used critical thinking strategies. Conversely, the more a course used finals/midterms and non-graded assignments, the less students reported spending time thinking critically.

Table 3. Significant Relationships between Course Assessment Variables and Student Learning Strategy Variables

Learning strategy	Positive relationship	Negative relationship
Rehearsal	--	--
Elaboration	Number of assessments $r(408) = .101^*$, $p = .041$ Number of discussions $r(408) = .181^{**}$, $p = .000$ Number of journals $r(408) = .102^*$, $p = .040$	Number of pretests $r(408) = -.131^{**}$, $p = .008$ Number of finals/midterms $r(408) = -.142^{**}$, $p = .004$ Number of non-graded methods $r(408) = -.147^{**}$, $p = .003$
Organization	Use student feedback to correct class misunderstandings $r(342) = .124^*$, $p = .022$	--
Critical thinking	Number of discussions $r(410) = .151^{**}$, $p = .002$ Number of written assignments $r(410) = .102^*$, $p = .039$ Number of papers $r(410) = .115^*$, $p = .020$	Number of final/midterms $r(410) = -.098^*$, $p = .047$ Number of non-graded assignments $r(410) = -.167^{**}$, $p = .001$ Number of non-graded methods $r(410) = -.179^{**}$, $p = .000$ Number of assessors $r(410) = -.118^*$, $p = .017$
Metacognitive self-regulation	--	Number of pretests $r(409) = -.124^*$, $p = .012$

$^* p < .05$. $^{**} p < .01$.

E. Motivation

Motivation has been shown to be linked to performance along with learning strategies [22]. Although motivation was not a central part of this study, it was taken into account as a possible contributing factor. The initial value placed on the subject or course by a student, often called entering course value, has been shown to be the strongest predictor of cognitive and metacognitive learning strategy use [40]. Accordingly, students were asked their main reason for taking their online course. The majority of these students, 70%, said they took this class because it was required. Others reported taking the class because they want or need to learn the material, 16%; or because the course seemed interesting, 11%; or because they thought it would be easier online, 2%. Analysis of variance showed the mean differences between groups representing why a student took the course were statistically significant at $p < .01$ for three of the learning strategy subscales: rehearsal, $F(3, 405, 408) = 3.96$, $p = .008$; elaboration, $F(3, 405, 408) = 4.45$, $p = .004$; and critical thinking $F(3, 407, 410) = 5.44$, $p = .001$. Post hoc tests for all three subscales showed motivation did play a role for these learning strategies in that students who thought online courses would be easier showed lower reported use of these strategies. However, these results should not influence overall study results as only 2%, 10 of 411, students took the course for this reason.

F. Limitations

As with any research study, there are certain limitations that should be noted. This study attempts to create a picture of typical assessment practice within online courses. However, it only represents the practices of one institution at the community college level. Although the online environment is unique in that an entire course and all its interactions can be observed by an outside researcher, certain aspects of the study such as the use of formative assessment practices and student learning strategies were collected from self-reported measures. As already mentioned, the response rate for the student survey was representative of the population, but was low, and the role of student motivation was not directly explored. In addition, the instrument used to determine learning strategies was originally designed for the face-to-face classroom environment. Although the constructs of learning remain the same, it is possible that there are different emphases or even additional learning strategies that exist within the online environment, such as collaboration and discussion strategies, that are not included in this taxonomy. There is likely more to be learned about online learning strategies than may be shown through the use of this instrument.

IV. SUMMARY/CONCLUSIONS

Course assessment is important in determining the type and quality of learning occurring in a class. Because assessment is different online, and little literature exists about online assessment practices, this study helps lay a foundation for future studies by providing a description of online assessment and learning and suggesting ways that the two are related. To begin with, the results of this study allow a picture to be drawn of typical assessment practices in online courses at Colorado community colleges. In brief, a typical course would consist of 29 assignments and use five different assessment methods. Assignments would be due in at least 10 of the 15 weeks. The course would likely use seven non-graded assignments but there would be no group activities beyond discussions. The instructor would say the goals of the course require the use of all the learning strategies explored in this study and students would report to use all those strategies with similar emphasis. The instructor would interact with each individual student well over 10 times during the course, responding to comments and questions within 24 to 48 hours. And although the instructor would claim to frequently provide specific and precise feedback to students, he or she would feel that students are using that feedback only about half the time. The instructor would also not be making many changes to the course during the semester.

A. Summative Assessment

The status of summative assessment in these online classes appears for the most part to be in line with the four areas of effective practice explored in this study. These courses use a variety of assignments and methods. Online methods of exams, discussions, written assignments, problem assignments, experiential activities, and others tap different cognitive processes. Many larger assignments are even broken down into smaller pieces focusing on different aspects and graded over time. These classes appear to tap multiple dimensions of learning because students claim to use a variety of learning strategies. Multiple assessment methods that assess multiple dimensions of learning allow students to both challenge their weaknesses and draw on their strengths. Also, these classes assessed learning over 15 weeks. Such continuous assessment allows instructors to provide relevant feedback and gives students the opportunity to learn from their mistakes [41, 42]. In essence, a course where student work is graded though a midterm and final exam would be considered less beneficial to student learning than one where student work is graded in many ways throughout the semester [32]. This latter example is what seems to be the norm in these online classes.

One area of possible concern with summative assessment is the number of assignments used in a course. Although multiple, smaller assignments are deemed better than just a few high-stakes assignments, there is indication that the number of assignments in some of these classes could be too high. Some courses used 50, 60, and even 90 assignments in a 15-week period. In a course with too many short assignments, students are at risk of focusing their attention on the accumulation of a quantity of assignments rather than more complex and complete understandings of course material [43]. An instructor grading this many assignments for 20 students would likely be inclined to grade for quantity over quality. This aspect of assessment was not explored in depth, but it appears that although more assignments may be better than too few, online instructors need to be cautious of using an excess of assignments.

Another area for potential improvement in summative assessment is the use of multiple assessors. Only two of the 60 courses in this study used any form of peer review and none used peer grading techniques or collaborative projects. This finding was surprising in light of the numerous benefits attributed to peer review [44] and collaborative activities in online education [45, 46, 47]. Also, although over half of these online classes used self-assessed activities in the form of non-graded assignments, most of these assignments appeared to be added with little support from instructors regarding their use. In self grading, even adult learners need guidance and direction to become self-directed learners and to learn to use resources effectively [48]. Textbook publishers are making their content more marketable by creating numerous non-graded supplemental activities. However, adding these assignments without guidance simply because they are available may not always be the best course of action for student learning.

B. Formative Assessment

The status of formative assessment in terms of effective practice in student-instructor feedback was also fairly encouraging in these courses. The online instructors in this study reported to provide timely, frequent, and precise feedback to students. Because instructors are spending their time responding to students rather than in class conducting lectures and teaching activities, the individualized nature of their feedback is likely the case. Online instructors in general report that they know their students better than they would in a larger on-campus class [49]. This more relevant, reflective, and specific feedback is seen as much more beneficial for student learning [50, 51]. While this study does not speak directly to the quality of the feedback given, the presence of regular feedback appears to be the norm online.

However, the actual use of this frequent feedback was not as strong. Instructors did not appear to make many changes to their courses. Online instructors are known to continually revise their courses [1]. Yet

less than half of the instructors in this study reported to frequently make changes to the course including adjusting assignments or discussion questions. This could be due to the nature of the courses and adjunct faculty in this sample. Courses predesigned by a team of developers and taught by adjuncts keep a large number of courses more manageable, but can reduce the ability of instructors to adjust the course to meet the needs of current students. Adjusting assignments and teaching techniques based on an emerging understanding of students is an essential part of formative assessment [43].

Similarly, instructors in this study felt that students only utilized instructor feedback about half the time. Students must seek meaning and act on feedback if it is to ultimately be effective [5]. This means students should have not only the desire but the opportunity to learn from instructor comments and suggestions. Although instructors cannot control student desires, they can ensure students have regular opportunities to act on feedback and learn from their mistakes. As with the other feedback variables, this was not explored from the students' perspective. However, there appears to be some disparity between the amount of specific feedback provided by instructors and the use of this feedback by students.

C. Learning Strategies

There are many ways to explore learning. Students' use of different learning strategies provides insight into the type and quality of learning occurring in a course. In this study, students claimed to be using a variety of the five learning strategies explored. Rehearsal and organization strategies were used the least across courses. Similarly, instructors said they wanted students to be doing these strategies less than the other strategies. To some extent, this could be due to the absence of a means to test for memorization online. In many online courses, exams are considered open book and questions test for skills other than knowledge retention. Also, because there is no lecture time, many courses have lecture notes, instructor comments, or orienting diagrams that highlight key points. These aids may replace the need for students to use organization strategies. Two of the highest reported uses of learning strategies and goals of instructors were the elaboration and critical thinking strategies. The use of these strategies involves obtaining some initial knowledge of course content and taking it to the next step of applying that information or developing a new way of thinking about it. From this study, online courses appear to focus assessments on a student's ability to access and utilize information and resources, rather than to organize knowledge or retain it for an exam. In today's ever-changing global economy, higher education is being asked to produce knowledge workers who can use resources to continually adapt and improve their knowledge and skills rather than memorize [52]. When the MSLQ was created in the 1980s, surface rehearsal strategies were the most commonly used strategy by college students [21]. However these online courses show a focus on more complex learning strategies.

Metacognitive self-regulation strategies were also a strong goal of instructors and had high student use. Because online courses have no weekly class time and require self-reliance, it is no surprise that self-regulation skills would be a big component. However, it should be noted that self-regulation strategies take time to develop and need support to do so [53]. While online students are expected to use self-regulation strategies, they still likely need assistance transitioning the responsibility of learning to themselves. In addition, there may likely be some additional collaborative learning strategies occurring regularly in online classes that did not appear within the confines of this study.

D. Course Assessment Practices and Learning Strategies

This study also sought to explore how assessment practices relate to student learning strategies. Although many of the learning strategies showed significant relationships with a few assessment variables, the most relevant and interesting relationships were found with the critical thinking strategy. Small correlation

sizes indicate that influencing student learning is a complex undertaking with many variables involved. However, if critical thinking is an important goal of an online course, there are some methods that appear likely to lead to more critical thinking strategy use among students. These relationships were also supported and explored in more depth by a qualitative phase of this study that is not presented here. In essence, written assignments, longer papers, and discussions have the explicit purpose of making students spend time formulating their own ideas about course concepts. Making these assignments a high percentage of the course grade and using a number of them should be linked to higher uses of critical thinking. On the other hand, using more non-graded assignments seems to encourage strategies other than critical thinking. In this study, these types of assignments tend to focus on retention, knowledge, or procedural skills. Such skills may be the focus of some classes, but most of the courses in this study had at least some critical thinking objectives for students. To put it plainly, if instructors want students to spend time thinking critically, they should use assignments that explicitly ask students to focus their study efforts on critical thinking tasks.

Assessment is important in determining the type and quality of learning occurring in a course. Because assessment can be so different online, there is a clear need for more empirical study in this area. There are many ways to conceptualize and study assessment. This article lays the groundwork for future studies by providing a description of various dimensions of summative and formative assessment in online courses and identifying some potential aspects for optimism and for improvement. The courses in this study use multiple and alternative methods, disperse grades over time, and instructors provide timely and frequent feedback. These assessment practices ask students to focus on, and students report to focus on, relatively more complex learning strategies such as elaboration and critical thinking over rehearsal. However, online instructors need to continually ensure that assignments are used only if they actively contribute to the kind of learning desired and that the tremendous amount of feedback given is productive, beneficial for learning, and able to be acted upon by students. In the end, instructors should be strategically using course assessment to concentrate student efforts on activities that explicitly bring out the learning strategies desired.

V. REFERENCES

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VII. ABOUT THE AUTHOR

Bridget Arend is Research and Assessment Analyst for the Center for Teaching and Learning and Adjunct Faculty at the University of Denver. She received her PhD in Higher Education and Adult Studies from the University of Denver in 2006. She also teaches and consults in the areas of assessment, learning, and online education. She has 15 years experience in instructional design, research and evaluation, and faculty development in K-12, higher education, and corporate environments and has published and presented about various topics associated with online education.

VIII. APPENDIX I

Variables Collected Through Researcher Course Observations

	Variables
1	Course ID
2	Credit hours
3	Number of students (from enrollment statistics)
4	Academic program
5	Course level
6	For each assignment within the course:
a	Method, in instructor's words
b	Method, using researcher's code
c	Assessor (instructor, self, peer, other)
d	Number of (for that assignment)
e	Placement (week(s) assessed within course)
f	Points towards final grade
g	Percentage of final grade
7	Total number of summative assignments
8	Total number of summative methods used
9	Number of assessors used
10	Number of weeks assessed
11	Number of weeks assessed, including ongoing discussions
12	Total number of non-graded assignments
13	Total number of non-graded methods used
14	Percentage of grade for each assignment method
15	Detail of assignment instructions (high, moderate, low)
16	Detail of discussion instructions (very detailed, general guidelines, basic instructions)
17	Researcher comments/observations about the course

USING RUBRICS AND CONTENT ANALYSIS FOR EVALUATING ONLINE DISCUSSION: A CASE STUDY FROM AN ENVIRONMENTAL COURSE

Maha Bali
Center for Learning and Teaching, American University in Cairo, Egypt

Adham R. Ramadan
Department of Chemistry, American University in Cairo, Egypt

ABSTRACT

This paper presents a case study of using course-specific rubrics combined with content analysis, together with instructor and student feedback, to assess learning via online discussion. Student feedback was gathered via Small Group Instructional Diagnosis, and instructor feedback was collected through formal interviews. Content analysis used emergent coding with different assessment criteria for each phase of the online discussion. Student participation was high, with a number of students feeling they learned beyond what was discussed in class. Some students however were overloaded by the large number of postings and repetitiveness during some of the phases of the discussion. The instructor was pleased to find students who were quiet in class being active in the online discussion. However, he found that student contributions demonstrated insufficient reflection and critical thinking. Content analysis showed that students met, on average, 59-82% of the essential assessment criteria in their postings, and that their contributions significantly improved as the online discussion progressed. However, a limited number of postings reflected critical thinking. In using online discussion, the use of assessment criteria is therefore commendable, as it was found that content analysis gave an insight beyond student and instructor perceptions. The insights gleaned from the methodology indicate its usefulness in assessing online discussion activities more objectively, and with respect to specific learning objectives.

KEYWORDS

Action Research; Asynchronous Discussion; Computer Conferencing; Content Analysis; Environment; Online Discussion; Rubrics

I. INTRODUCTION

The American University in Cairo (AUC) is an American liberal arts university based in Cairo, Egypt. Its language of instruction is English. It follows a semester system, encompassing 15 working weeks. Classes usually meet two to three times per week, and consist of up to 40 students. No degree courses are offered via distance learning, but some instructors add an online component to their courses without reducing face-to-face contact time, using the learning management system WebCT.

The course ‘Man and the Environment’ is an introductory course to environmental science that students of non-science/engineering majors can choose to take in order to fulfil the general science requirement of their liberal arts degree. The course aims at presenting the principles of environmental science, together

with the primary concerns of natural resource management and the major challenges for environmental protection on a global scale. At AUC, this is carried out through four modules. Module I presents the fundamentals of ecosystems and how they operate particularly with respect to energy and nutrient cycles. Module II focuses on the major natural resources and their management. Module III is concerned with environmental degradation and global initiatives to combat it. Module IV relates environmental management and protection to diverse issues such as economic development, policy, law, and sustainable development. The four modules are of different sizes with module III being the largest. This primarily stems from the fact that environmental degradation is reaching serious dimensions globally, and particularly so in Egypt. Students' understanding of details and dynamics of such degradation, as well as ways and initiatives to combat it, is of crucial importance to their commitment to environmental protection. In this respect, it was considered important that students be able to identify issues of primary environmental concern and critically reflect on why these issues persist, while realizing the complexity of their interdependence. Egypt was used as an example of a developing economy faced with serious environmental challenges. Proposing possible solutions to issues of concern would help students appreciate the complementary roles of different entities such as individuals, civil society, regulatory bodies, private businesses, the political establishment, and others.

Class time was not enough for extensive discussion and exchange of experiences and opinions, especially concerning a topic of such complexity. The instructor therefore needed to find an 'innovative' way to carry this out outside of class time.

II. WHY ONLINE DISCUSSION?

Asynchronous online discussion seemed to be an appropriate pedagogical tool to meet the above needs. It allows students to discuss the issues online and outside of class time [1]; it is praised for promoting student reflection [2] and for encouraging those students who are reluctant to speak up in class [3]. Moreover, conversations are recorded [4, 5], which allows both the instructor and the students to refer to them later.

In this respect, and for the purposes of this course, online discussion was particularly suitable as a significant number of students seemed hesitant to speak up in class. In addition, recent research [6] found that 71% of surveyed AUC students (n = 99) who had online discussion as part of a course they took agreed or strongly agreed that it enhanced their learning experience. However, the investigators were aware of the most commonly cited limitations of online discussion [1, 7] , namely, the effect of its text-based dryness on learning particularly for visual learners; too many unread postings causing information overload, potentially de-motivating students and causing them to stop participating; the reluctance of some students to participate altogether; and the fact that some students read but do not post (also known as 'lurking') which is often seen as unfair to the other students.

A majority of students taking the course were found to be already familiar with WebCT, the learning management system used at AUC (74% were moderately or very experienced with it). They were also generally experienced with web technologies such as email (100%) and internet (89%), so no technical access issues were anticipated which might have reduced their participation in the online discussion.

Online discussion had been used within the context of this course for three semesters before this research was carried out. Students were awarded bonus marks for submitting 'good quality' postings. However, this was subjective, and it was considered important to measure the impact of this pedagogical innovation on student learning and motivation. In this respect, it was decided that an 'action research' project be

carried out in the Spring 2005 semester, as a collaboration between the course instructor and the Center for Learning and Teaching (CLT) at AUC, to collect feedback from students and conduct a content analysis of the online discussion transcripts. This would result in data gauging student perceptions and measuring actual student learning that had occurred.

A significant number of studies have been conducted on online discussion. However, they have either focused on totally online courses (e.g. [2, 8, 9]) or on blended courses where in-class engagement was difficult because of large numbers of students (a number of the examples in [5, 10]. In addition, there is insufficient research addressing explicit learning gains achieved [5]. Some researchers conducting a study on blended courses with small classes, focused on learner perceptions only [11-13], and did not go further to conduct content analysis on student learning. Others [14, 15] did recommend the use of rubrics to assess student learning objectively, but did not go further to use rubrics in conducting content analysis. Although some researchers conducted content analysis of online discussion for small numbers of graduate students in a blended learning context, they based their content analysis on a predetermined framework rather than a course-specific rubric set [16, 17]. Others developed rubrics and analyzed them to assess the effectiveness of interaction in distance courses, but not learning [18]. Meyer developed a rubric set to assess the quality of online courses, but again, this was not directly applied for assessing learning [19].

The investigation presented here is unique: course-specific rubrics combined with content analysis, as well as student and instructor perceptions, are used in order to measure learning via online discussion. This is carried out in a course with a small number of non-native English-speaking students meeting three times per week.

III. PURPOSE OF THIS STUDY

This study aims to investigate how online discussion can be used to achieve learning goals and specific learning objectives. In this respect, one of the overarching learning goals for using online discussion was to encourage students to apply what was presented in class to specific examples from their daily experiences in order to deepen their awareness of the issues at hand. A second goal was to assist them in developing their reasoning skills, and encourage critical thinking and analysis instead of memorization. These overarching goals were also translated into specific learning objectives as specified in section IV-B.

This study is unique in that content analysis of the online discussion is carried out based on ‘rubrics’ specific to the activity’s learning objectives, rather than applying a general framework. It is hoped that the results of this study demonstrate the benefit of combining rubrics with content analysis in assessing learning. Moreover, this study explores the usefulness of using online discussion in small classes where students meet regularly, as opposed to large classes and distance courses.

IV. RESEARCH METHODOLOGY

The two known methods of measuring quality of online discussions are ‘learner feedback’ [11] and ‘content analysis’ [16, 17] with content analysis considered to be the more revealing [9, 16]. In this respect, an action research approach was followed, triangulating the results of the content analysis of online discussion transcripts with feedback from students and the instructor’s own perceptions.

A. Structure of the Online Discussion Activity

The online discussion was structured into four separate but related cycles, each cycle addressing a certain aspect of the environmental status in Egypt. The length and timing of each cycle would depend on student feedback, lasting from about one to two weeks, and beginning on the same day the preceding cycle ended. The topic tackled in cycle one (*"What do you think the major environmental challenges in Egypt are?*") was set in advance, but the exact topics tackled within cycles two to four were not pre-set. The progression of these topics was developed in response to the way student participation and feedback proceeded. Students would get 'bonus' marks for posting 'meaningful contributions'. However, they were not given any assessment criteria. The cycle topics and learning objectives are included in Table 1.

B. Content Analysis

Some researchers use pre-existing cognitive frameworks to conduct content analysis on online discussion transcripts, for example comparing Bloom's taxonomy and Perry's Intellectual Development model [17], while others use frameworks specifically developed for online discussion or develop their own [16, 20]. Although this approach has the advantage of focusing on certain aspects of the learning activity, it limits the scope of conclusions, hides other aspects of data not present in the framework, and is unlikely to directly meet every learning activities' unique objectives [21, 22]. It was decided not to use any of the available analysis frameworks in the literature, such as that of Henri [20], or Gunawardena, Lowe and Anderson [23], or the Transcript Analysis Tool [22], because they were either too sophisticated for the level of the students (e.g. Henri's metacognition category was unlikely in any of the postings) or they were developed for a different type of learning activity (e.g. Gunawardena's framework refers to a learning activity that involves argumentation and resolving a problem collaboratively). Using any of these would not allow effective assessment of learning objectives specific to the particular course and activity at hand. However, some features of Henri's [20] model were adopted in the current research, by including quantitative data on participation, and keeping track of postings that were 'reactive', i.e. offering a reaction to the contents of other postings (corresponding roughly to Henri's 'interactive' category).

In this respect, a number of assessment criteria, 'rubrics,' were developed by emergent coding to be used in the content analysis. Emergent coding is a methodology that builds coding categories from existing transcripts instead of applying a pre-existing external framework to the transcripts. In the case of this investigation, the transcripts are the online discussion transcripts, and this approach was deemed more appropriate for the investigation since none of the existing frameworks could directly meet the learning objectives set by the instructor.

The authors read through the online discussion transcripts together, keeping in mind the primary learning objectives, as specified in Table 1, and then devised a set of rubrics to measure these learning objectives. The rubrics for the different cycles were therefore different, depending on the set learning objectives for that cycle. However, they also encompassed some generic criteria applicable to all cycles, such as correctness of information supplied, and originality. The posting was used as the unit of analysis, and all the cycle rubrics were applied to it. Scoring was carried out in a binary fashion with a rubric receiving a score of either '1' (yes) or '0' (no) depending on the content of the posting. Some of the rubrics were essential in assessing the learning objectives, whereas others were a 'bonus' (i.e. the students were not expected to meet them, but those who did were considered more advanced). For example, one rubric "Original" was defined as "posting contains at least one original idea," as opposed to one which is repetitive of another posting, even if reworded, and this "originality" criterion was expected of all students. An example of one of the "bonus" rubrics is one that was named "Building" and is determined on whether a "posting builds upon what is in another posting, developing it and/or adding new information," with the purpose of demonstrating if students have built on what their peers have

contributed as opposed to either ignoring it or repeating it. The details of these rubrics and the points they investigate are presented in Table 2.

Cycle Details	**Rubrics Used**
Cycle I: *What do you think the major environmental challenges in Egypt are?* Primary learning objective: Apply principles covered in class to daily conditions to identify environmental problems	*Essential:* [Direct], [Effects], [NotIncorrect], [OnTopic], [Relevant], [Sources], [Totality] *Bonus:* [Connections], [MultipleChallenges], [Originality]
Cycle II: *Why do you think these environmental challenges persist today in Egypt?* Primary learning objective: To be able to critically consider the identified environmental challenges and identify the factors underlying the inability of having them addressed	*Essential:* [CauseEffect], [NotIncorrect], [OnTopic], [Original], [OverallCauses], [Relevant] *Bonus:* [MultipleReasons], [JumpsToSolutions], [RelatesCauses]
Cycle III: *How do you think the causes for the persistence of environmental challenges in Egypt today could be addressed (what are possible solutions)?* Primary learning objective: To be able to go beyond identifying problems towards thinking of and identifying possible solutions	*Essential:* [Implementable], [NotIncorrect], [OnTopic], [Original], [RelatesDiff], [Relevant] *Bonus:* [Building], [Critical], [MultipleSolutions]
Cycle IV: *What entities do you think are responsible for implementing the solutions identified in cycle III?* Primary learning objective: To identify the complementarity of roles and responsibilities of different entities in addressing environmental challenges in Egypt	*Essential:* [AwareAccounts], [MultipleRoles], [NotIncorrect], [OnTopic], [Original], [Relevant] *Bonus:* [Building], [Critical]

Table 1. Cycles I to IV: Questions, Primary Learning Objectives, and Rubrics Used for Posting Content Analysis

Rubric Name	Explanation
[AwareAccounts]	Does the posting demonstrate an awareness of the accountability of different entities?
[Building]	Does the posting build upon what is in another posting, developing it and/or adding new information?
[CauseEffect]	Does the posting identify the relationship between the cause and the effect?
[Connections]	Does the posting make the connection between several challenges?
[Critical]	Does the posting demonstrate critical evaluation of the solution it suggests?
[Direct]	Does the posting refer to a direct environmental challenge? (as opposed to an indirect one resulting from another more basic challenge).
[Effects]	Does the posting specify the effect(s) of the environmental challenge(s)?
[Implementable]	Is the method suggested in the positing for addressing the causes of persistence of environmental challenges implementable?
[JumpsToSolutions]	Does the posting specify solutions?
[MultipleChallenges]	Does the posting specify more than one challenge?
[MultipleReasons]	Does the posting specify several reasons to the persistence of environmental challenge, and/or several effects of an identified reason?
[MultipleRoles]	Does the posting demonstrate an awareness of multiple roles and responsibilities?
[MultipleSolutions]	Does the posting suggest several solutions to the identified reason?
[NotIncorrect]	Does the posting contain incorrect information?
[OnTopic]	Is the posting within the topic under discussion? (as opposed to addressing a topic unrelated to the discussion).
[Original]	Does the posting contain at least one original idea? (as opposed to one which is repetitive of another posting, even if reworded).
[OverallCauses]	Does the posting refer to general overall causes of the environmental challenges (such as lack of awareness, legislation, enforcement of legislation, financial constraints)?
[RelatesCauses]	Does the posting specify how several causes interact to render an environmental challenge persistent?
[RelatesDiff]	Does the posting establish a connection between different causes for the persistence of environmental challenges and any one particular solution?
[Relevant]	Does the posting address issues that exist in Egypt?
[Sources]	Does the posting specify the source(s) of the environmental challenge(s)?
[Totality]	Does the posting demonstrate that the student is aware where/how the specified challenge fits in the total environmental status?

Table 2. Details of Rubrics Used in Posting Content Analysis

The rubrics were developed taking into account the learning objectives, and then applied to sample sets of postings for each cycle by both investigators collaboratively. These postings were chosen so as to form as much of a representative sample with regards to length and content as possible. This collaborative coding approach was carried out to hone the rubric definitions, increase objectivity, and achieve a level of inter-rater agreement on how to interpret each rubric and assess postings. Rubrics developed for each of the four cycles are presented in Table 1. All postings, including the sample set, were then coded using the finalized rubrics. To ensure intra-rater reliability, the resulting coding of the sample sets was then compared to their initial coding. Coding was not carried out by both authors on purpose, since in an authentic situation, assessment of online discussions is likely to be carried out by the course instructor only, with the emergent coding approach ensuring consistency of the application of each rubric. The finalized coding was then used to analyze patterns in all postings. A tailor-made Access-Excel package was developed for coding and for analyzing patterns in all postings.

C. Instructor and Student Perceptions

The instructor's perceptions were collected via two formal interviews and several informal discussions throughout the semester. On the other hand, student feedback, giving an insight into the educational situation [24] was collected via Small Group Instructional Diagnosis (SGID). This is a structured group interview process [25] that takes place in the absence of the instructor. Groups of students are asked about what they believe helps them learn in a course and how improvements could be made. SGIDs produce both written and oral feedback. For this research, a number of questions directly pertaining to the students' perceptions of the online discussion activity were added:

1. Do you feel that the online discussions have helped you connect the course with real life (Egyptian environmental problems) more than if you hadn't had them?
2. Did you know beforehand that the instructor uses online discussions and that it could improve your grade?
3. Do you feel the online discussions have motivated you?
4. Is your opinion online affected by what the instructor seems to think is a good answer?
5. What could have been done to improve online discussions? [this question was created on the spot to address the issues that students said came up with online discussions]

In addition, a demographic survey was conducted at the beginning of the semester. Laurillard [26] advocates conducting such surveys to understand more about students' backgrounds and what they bring to the course. The survey included questions on students' familiarity with technology, to rule out its lack as a possible hindrance to effective student participation. The majority of students were very familiar with web technology, and therefore it can safely be concluded that it does not present a hindrance to any of them for contributing to the online discussion.

V. RESULTS AND DISCUSSION

A. Instructor Perceptions

According to the course instructor, student engagement in online discussion can demonstrate significant variations from semester to semester. For the Spring 2005 semester, during which the current research was conducted, a significant number (25%) of students were quiet in class but very active online. This was primarily due to limited spoken English skills, which made these students reluctant to speak up in class. The course instructor was satisfied with the overall student performance in online discussion, although his perception was that their critical thinking skills were not developed well enough, and that

some students just posted without giving their writing much thought. This was based on the absence of clear indications in the postings that students were capable of recognizing relations existing between environmental challenges which they had successfully identified; that they were aware of multiple causal relations, as for example between one cause and several effects, and/or several causes to one effect; that they were aware of the limitations and/or difficulties of some of the solutions they were putting forward for addressing identified environmental challenges; and that they were aware that some challenges could be addressed through different possible solutions. Another issue of concern was the recurring convergence of a significant number of students on one issue, failing to look beyond it into others, or to develop it further. This was of particular concern when the issue was an obvious one, not necessitating much debate, or discussion (e.g. the lack of awareness being a cause of environmental degradation), thus leading to considerable repetitiveness in the postings.

B. Student Perceptions

When students were asked for feedback about online discussion in an SGID conducted during the fourth cycle of the discussion, ten students wrote that online discussion was an important factor in helping their learning in the course; six said online discussion helped them connect the course with environmental issues in Egypt, and six said the activity motivated them. These numbers need to be considered in light of the number of students who contributed to online discussion (32 students) rather than the total number of students in class (40 students). Furthermore, some students complained of 'information overload', stating that they stopped contributing to online discussion when postings became too many and too repetitive, with postings concurring to stated opinions without any further contributions. This is indeed valid feedback considering that the SGID conducted during the fourth discussion cycle, came right after the third cycle, which had the highest percentage of repetitive postings (Figure 1).

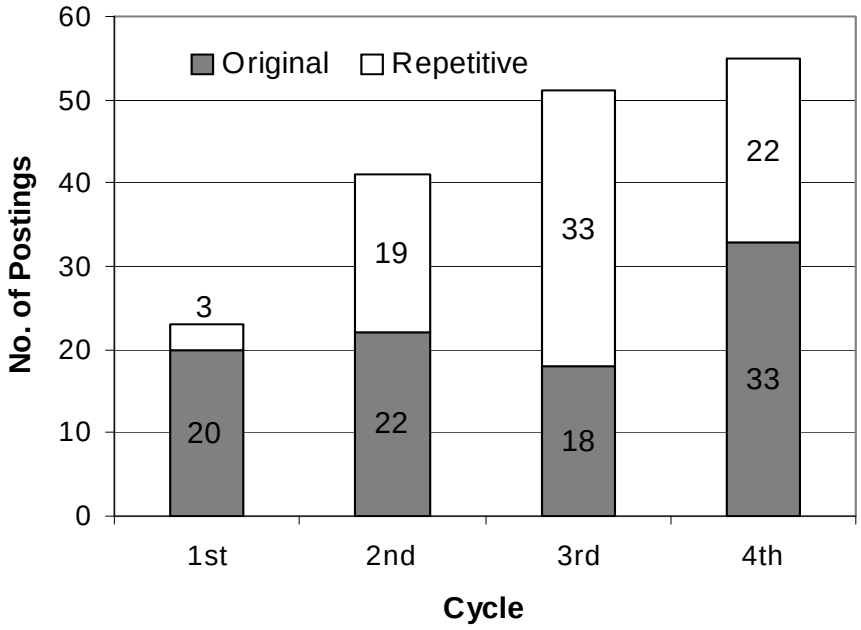

Figure 1. Number of 'Repetitive' Postings for the Total of Student Postings

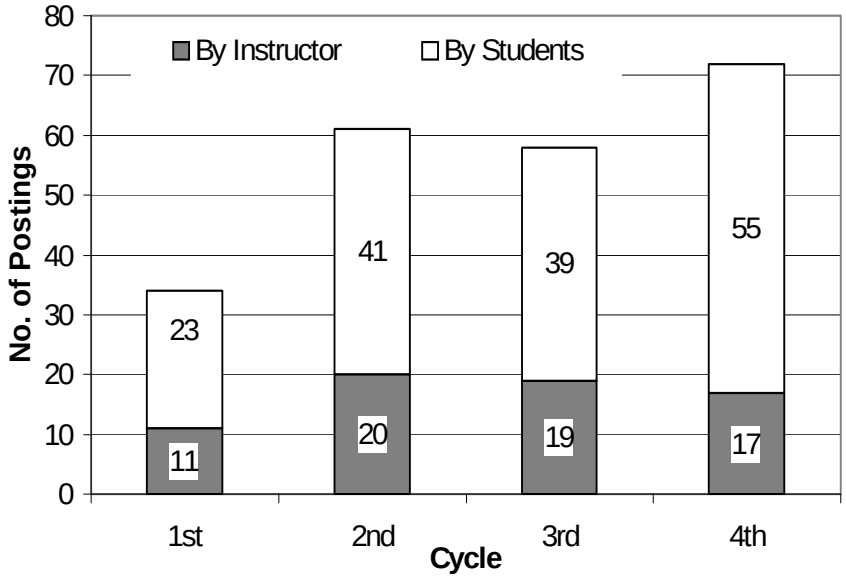

Figure 2. Student and instructor postings for Cycles I to IV of the online discussion

C. Content Analysis

	Length of Cycle	No. of Student Postings	Average No. of Student Postings per day	No. of Students Participating	Average No. of Postings per Student	Average Word Count per Student Posting
Cycle I	5 days	23	4.6	19	1.2	101
Cycle II	9 days	41	4.6	25	1.6	105
Cycle III	18 days	51	2.8	21	2.4	100
Cycle IV	15 days	55	3.7	20	2.8	115
Totals	47 days	170	Not applicable	32 different students (out of a total of 40 in class)	Not applicable	Not applicable

Table 3. Quantitative Details for Each of the Four Cycles of the Online Discussion

Table 3 presents quantitative details for each cycle. The number of student postings and the number of students participating are indicative of the degree of engagement of the class as a whole, whereas the average number of postings per student and the average word count per student posting are indicative of the level of engagement for each of those students participating in the discussion. Figure 1 presents the number of 'original' versus 'repetitive' postings, and Figure 2 presents the number of student postings and those of the instructor for each cycle. The overall trends in these variables throughout the four cycles are summarized in Table 4.

Variable	Trend
Length of a cycle	General increase, with a maximum in Cycle III
Number of student postings	General increase, with a maximum in Cycle IV
Average number of student posting per day	General decrease with a minimum in Cycle III
Number of students participating	Stable, with a maximum in Cycle II
Average number of postings per student	General increase
Average word count per student posting	General increase
Percentage of 'repetitive' student postings of the total	Lowest for Cycle I, stable for the other cycles, with a maximum in Cycle III
Percentage of instructor postings of the total	Stable but decreased in Cycle IV

Table 4. General Trends for Contributions to Online Discussion

1. Student Engagement

The results show that as online discussion progressed, an increase in student engagement occurred. This is reflected in the increase of the total number of postings, as well as the average number of postings per student. The decrease in the average number of student postings per day should not be considered a contradiction to the general increase in student engagement. It is believed that this is due to external factors such as the approach of the end of the semester with all the associated deadlines of term papers and projects. Students getting busier with other required course work (as opposed to the 'bonus' online discussion), would post fewer messages per day. Nevertheless, the total number of postings per cycle increased and the average number of postings per student increased steadily, demonstrating a continued interest and engagement in the online discussion. Fewer student postings per day resulted in prolonging the last two cycles: it took more days to discuss the topics at hand thoroughly. Instructor engagement in the first three cycles was similar, and decreased significantly in the fourth cycle (Figure 2). This ruled out the possibility of the instructor's engagement in the discussion as being the cause of the increased student participation.

2. Repetitiveness

Regarding the repetitiveness issue which some students raised during the SGID, it was found that it started by being exceptionally low (13%) in the first cycle, increasing to 46% in the second cycle, and reaching a noticeable maximum of 64% for the third cycle, then decreasing once more to 40% in the fourth cycle. These figures need to be considered in light of the instructor encouragement (in his postings) of students reacting to one another's postings. Though a number of students succeeded to do so, using the content of their colleagues' postings to further develop ideas and express opinions, a significant number agreed to others' posting contents, repeating (though through rewording) the same ideas of the posting reacted to with no additions. The correlation between the exceptionally high occurrence of repetitions and the topic of Cycle III is noteworthy and is further discussed below.

3. Meeting Rubrics

Tables 5 and 6 present details of posting content analysis for the four cycles of the online discussion. It is clear from Table 5 that as the online discussion progressed, the quality of the postings generally

improved. The percentage of rubrics met, on average, increased. In Cycle I, 63% essential rubrics were met on average, whereas for Cycle IV 81% essential rubrics were met on average. The exception to this upward trend is Cycle III where 60% of essential rubrics were met.

	Average no. of essential rubrics met	Percentage of essential rubrics met	Mode for no. of rubrics met	Frequency at mode
Cycle I	4.4 out of 7	63%	4 and 5	6
Cycle II	4.4 out of 6	73%	5 and 6	11
Cycle III	3.6 out of 6	60%	3	15
Cycle IV	4.9 out of 6	81%	6	28

Table 5. Summary of Posting Content Analysis

The mode of rubrics met, as well as the frequencies at these modes, also improved as cycles progressed. In Cycle I, six messages (out of 23, i.e. 26%) met five of the seven essential rubrics. For Cycle IV, 28 messages (out of 55, i.e. 51%) met all six essential rubrics. Again, Cycle III was the exception to this upward trend, where 15 messages (out of 51, i.e. 29%) met only three of the six essential rubrics.

Cycle III data could be a reflection of a limited understanding of students of the topic under discussion "*How do you think the causes for the persistence of environmental challenges in Egypt today could be addressed*?"(i.e. why are these environmental challenges persisting?). Indeed, the percentage of postings meeting the rubric [OnTopic] is the lowest (82%) for all four cycles, as shown in Table 6. This limited understanding might explain the high level of repetitions seen in Cycle III. Some students not being very clear about the topic of discussion for the cycle, would tend to react to their colleagues' postings (particularly if they have been encouraged to do so by the instructor), by mostly agreeing to what is in them without further elaboration, criticism or development. These reactions would present the basis for further reactions, etc.

	Essential rubrics: percentages met		Bonus rubrics: percentages met	
Cycle I	[Direct]	57%	[Connections]	35%
	[Effects]	30%	[MultipleChallenges]	35%
	[NotIncorrect]	83%	[Originality]	87%
	[OnTopic]	87%		
	[Relevant]	78%		
	[Sources]	70%		
	[Totality]	39%		
Cycle II	[CauseEffect]	63%	[JumpsToSolutions]	37%
	[NotIncorrect]	73%	[MultipleReasons]	24%
	[OnTopic]	85%	[RelatesCauses]	32%
	[Original]	54%		
	[OverallCauses]	70%		
	[Relevant]	90%		

Cycle III	[Implementable]	41%	[Building]	31%
	[NotIncorrect]	94%	[Critical]	12%
	[OnTopic]	82%	[MultipleSolutions]	10%
	[Original]	35%		
	[RelatesDiff]	8%		
	[Relevant]	100%		
Cycle IV	[AwareAccounts]	67%	[Building]	60%
	[MultipleRoles]	73%	[Critical]	9%
	[NotIncorrect]	93%		
	[OnTopic]	98%		
	[Original]	60%		
	[Relevant]	100%		

Table 6. Percentages of Essential and Bonus Rubrics Met in Student Postings

4. Critical Reasoning Skills

A number of rubrics reflecting critical reasoning skills need to be more closely considered. For Cycle I, the essential rubrics [Totality] and [Effects] were met by 39% and 30% of the postings respectively, demonstrating that a significant number of students, though successfully identifying valid environmental challenges, were not clear about how the identified challenges related to one another and/or contributed to the detrimental environmental conditions. For Cycle III, the essential rubrics [Implementable], [Original], and [RelatesDiff] were met by 41%, 35%, and 8% of the postings respectively. The [Original] rubric reflects the high level of repetitions as discussed above. The [RelatesDiff] and [Implementable] rubrics scores demonstrate that multiple cause-effect relations were very seldom considered by students and solutions were suggested without giving much thought to whether they were implementable. Indeed this is also reflected by the very low scores of the bonus rubrics [Critical], met by 12% and 9% of postings in Cycles III and IV respectively, and [MultipleSolutions], met by 10% of postings in Cycle III.

5. Connecting the Course to Egypt's Environmental Problems

The overall objective for using online discussion was to help students make connections between the course contents and Egypt's environmental problems, as an example for a developing country with significant environmental challenges. The rubric [Relevant] was one directly addressing this point. It was met by 78% and 90% of postings in Cycles I and II respectively, and then met by 100% of postings in Cycles III and IV, demonstrating that this overall objective was successfully met by those students taking part in the online discussion, and that student increased engagement through the four cycles assisted in this.

VI. CONCLUSIONS

This investigation combines the use of rubrics and content analysis to both assess individual student learning and to gauge the entire class learning outcomes from online discussion. This is applied to a small class meeting regularly.

Using rubrics allowed objective assessment of learning against the instructor's cycle-specific learning objectives. Rubrics proved more beneficial than the instructor's own subjective assessment because they showed more learning than expected: the instructor could see how well students were doing with respect

to the over-arching learning goals, but the detailed rubrics pointed out specific areas of strength and weakness in each student's learning.

The use of emergent coding also proved more beneficial in practice than the use of pre-determined frameworks as it allowed an assessment specific to the activity's learning objectives. In addition, content analysis captured the wider picture of the entire class learning from the online discussion. It allowed the instructor to identify the learning objectives which were most difficult to achieve and the ones which were widely met. In this respect, the combination of rubrics and content analysis demonstrate that student learning was greater than student and instructor perceptions, and pinpoints a number of possible improvements to the activity which the instructor can apply in the future. These encompass informing students of the assessment criteria (rubrics) in advance in order to guide them towards the learning objectives, which is common practice for rubrics [27]; focusing questions and feedback on addressing specific deficiencies; dividing students into a number of smaller discussion groups to limit repetitiveness and information overload, as suggested by McConnell [1]; and referring to ideas expressed in the online discussion during class meeting times, thus encouraging students who made contributions [16].

In addition to the above, results also demonstrate that online discussion can be beneficial even when classes are small and meet regularly as it allows more in-depth appreciation of content implications, and a venue for quiet students to interact. Although some research [28] warns that learners for whom English is not a first language may suffer in online discussion, this investigation shows that, on the contrary, online discussion seems to be a better forum for such learners to express themselves, as they have more time to reflect and compose their answers than they would have for an oral discussion in the classroom.

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IX. ABOUT THE AUTHORS

Maha Bali is a Senior Instructional Technologist at the Center for Learning and Teaching of the American University in Cairo.

Adham Ramadan is an Associate Professor at the Department of Chemistry of the American University in Cairo.

COMMUNITY OF INQUIRY AND LEARNING IN IMMERSIVE ENVIRONMENTS

Ross McKerlich and Terry Anderson
Athabasca University

ABSTRACT

This paper describes an exploratory, observational study using a purposive sample selection to determine if the presence indicators of the well regarded Community of Inquiry model can be a useful tool to observe and assess learning events which use a Multi User Virtual Environment (MUVE) as the mode of delivery [1]. Specific research questions addressed include whether the Community of Inquiry is recognizable in a MUVE learning environment, if new presence indicators are required if observing a MUVE learning event and finally, does the community of inquiry offer a base rubric to determine the educational effectiveness of learning events which take place in a MUVE? The results are promising; while new presence indicators add breadth to understanding the nature of learning in an immersive environment the core construct of the community of inquiry does indeed transfer to this emerging learning technology.

KEYWORDS

Community of Inquiry, Multi User Virtual Environment (MUVE), Immersive Environment, Presence, Rubric, Learning Effectiveness

I. INTRODUCTION

Ever since the emergence of Multi User Dungeons (MUDs) and MUDs Object Oriented (MOOs) in the late 1970's, technology developers have been working to develop ever more immersive types of environments that can be widely accessed over digital networks. With the advent of 3D technology and faster Internet connections, the progress towards achieving this goal has been significant. It is predicted that immersive environments including a variety of educational applications will be adopted on a wide scale within two to three years [2]. Immersive environments offer exciting possibilities to distance educators as they have potential to significantly reduce the subjective feelings of psychological and social distance often experienced by distance education participants. Further, immersive environments can create a sense of presence [3] and flow [4] that enhance involvement and commitment to learning activity.

Just as there are many different types and platforms for immersive environments, so there are many different names to describe this new and evolving technology. For the purposes of this paper, immersive environments will be referred to as MUVEs, Multi User Virtual Environments [5]. The terms experimental and exploratory accurately describe the current higher education experience of MUVEs. To date, little is known about the educational effectiveness of immersive environments in campus based, blended or distance modes of education. The reception by educational researchers and pundits range from uncritical acclaim to skepticism, but regardless of the reaction, it is important for educators to keep abreast of technological advances to determine and enhance pedagogical value. This exploratory paper seeks to enhance our understanding of the educational potential of MUVEs by applying the tools and principles of the well regarded community of inquiry model [1] to describe and assess teaching and learning in these immersive contexts.

A. Community of Inquiry Overview

The community of inquiry (COI) model was developed as a framework for assessing the learning process and context in online environments in the late 1990's [1]. The COI celebrates the asynchronous nature of distance education that was prevalent at that time. The model and its component parts have been confirmed and replicated using a variety of research methodologies. Further, the COI model has been applied to educational contexts beyond computer conferencing, including face-to-face interaction [6]. However, the model has not yet been used to assess immersive environments. The purpose of this exploratory paper is to determine if the community of inquiry model is useful as a theoretical framework to describe and assess the educational effectiveness of avatar-to-avatar (A2A) teaching and to identify functional, dysfunctional and perhaps new indicators of social, cognitive and teaching presence.

The COI model is likely the most frequently cited tool used to evaluate formal distance education interaction and climate. Google Scholar lists over 150 citations for each of the 4 major papers and the book developed by the original COI authors. The seminal articles associated with this work as well links to the work of numerous researchers referencing and extending this work are available at www.communitiesofinquiry.com [7].

The COI model has its roots in Dewey's (1933) practical inquiry [8], Lipman's community of inquiry [9] and Garrison's (1991) model of critical thinking [10]. It uses this theoretical work to provide conceptual order and a practical heuristic model to assess learning in an asynchronous educational experience with extensive use of threaded text discussions. The model consists of three elements essential to an educational transaction: cognitive presence, teaching presence and social presence [11].

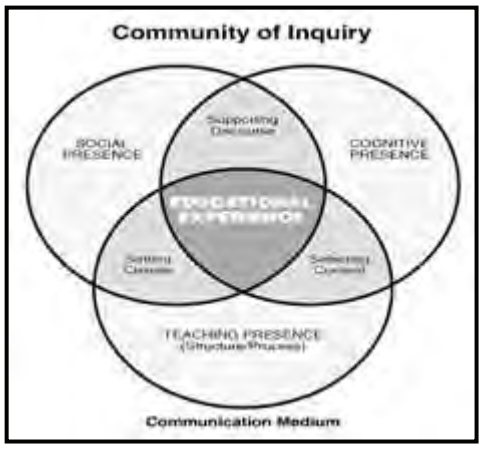

Figure 1. Community of Inquiry

Cognitive presence can be defined as the extent to which meaning can be constructed by sustained communication within a group of people [11]. Social presence is defined as the "ability to project their personal characteristics into a community thereby presenting themselves as real people to others in the group" [11]. Teaching presence involves design of the educational experience and facilitation of discourse among the group [11]. The underlying construct of the community of inquiry is that the optimal educational experience lies in the vortex of all three educational elements. It is this defining characteristic of the community of inquiry that allows it to be used as an evaluation tool. For example, if an educational experience has social presence and teaching presence but no cognitive presence then that missing element negates a critical component of the total educational experience and puts the educational effectiveness in doubt.

As part of the original research project, Garrison et al. created indicators of all three 'presences' so that transcripts could be analyzed and the extent of the three presences could be quantified. Table 1, below, shows categories and examples of indicators of the categories:

Elements	*Categories*	*Indicators (examples only)*
Cognitive Presence	Triggering Event	Sense of puzzlement
	Exploration	Information exchange
	Integration	Connecting ideas
	Resolution	Apply new ideas
Social Presence	Emotional Expression	Emotions
	Open Communication	Risk-free expression
	Group Cohesion	Encouraging collaboration
Teaching Presence	Instructional Management	Defining and initiating discussion topics
	Building Understanding	Sharing personal meaning
	Direct Instruction	Focusing discussion

Table 1. Community of Inquiry Indicators

Indicators were identified for each of the categories with the goal that quantitative content analysis would reveal the presence and reliable indices of the extent of each presence. It is important to note that in recent years, one of the architects has acknowledged that even if the goal of the original model was to produce a quantitative tool for data analysis, qualitative approaches still yield useful results [12]. A second caveat of the Community of Inquiry model is that the indicators listed above are merely examples—there are likely different indicators for different educational environments.

B. Immersive Environments Overview

As alluded to in the introduction, the definition and defining characteristics of any new and evolving educational technology is problematic. We have followed Dede's (1995) acronym of MUVEs to describe these Multi User Virtual Environments [3]. The immersiveness of the virtual environment is a simple yet powerful focus when trying to describe this net-based context. One blogger described immersion this way: "…content is 360 degrees with height and width and depth and texture and emotions that are capable of reaching the very depths of our hearts and brains in ways no 2D media can" [13]. To explore this imagery further, using immersive environments is like jumping off a dock into a lake—once jumpers commit they are quickly and totally immersed in water. So it is with immersive environments: once we enter a multi user virtual environment we become uniquely immersed in that environment whether it is a mock-up of an existing university campus or the re-creation of a 19th century city.

As a result of this immersion, engagement is enhanced [14], flow is supported [4], collaboration becomes both possible and supported [3] and the positive effects of new identity development and exploration are afforded [15]. In sum, these possibilities have ignited significant interest by educational researchers and teachers in exploring, testing and developing immersive contexts.

We have identified these predominant characteristics of modern internet accessible immersive environments: A MUVE is not a game, but rather a neutral and changeable environment that is co-created by the environment's designers and its users; the predominant navigation through a MUVE is by avatar—or a digital persona of the person using the environment; and the environment is 3 Dimensional: there is height, width and depth built using multiple media—sound, graphics, text and video. Robbins offered an extended list of characteristics of immersive environments that seems derived from Second Life, currently

the world's largest MUVE. These characteristics include the following: that there are multiple number of users; it is an image rich environment; the environment is accessed through a Wide Area Network; the environment is persistent (that is, the environment still exists when user logs out); whatever is changed in the environment stays changed; objects in the environment are owned by their creators and access can be limited; people can create their own identities through use of avatars; there is public access to the environment; and finally, relationships with other users are collaborative and conditional—not antagonistic [16].

The avatar characteristic is unique to MUVEs and can afford an engaging and salient educational experience. Walther describes selective self-presentation as part of his hyper personal model of computer mediated communication: users in a computer mediated communication environment will exploit technology to manage impressions and "facilitate desired relationships" [17]. Walther's research was conducted in a text environment; in a 3D immersive environment learners can take advantage of rich graphic technology to present themselves in a favorable way——or perhaps not even favorable to others, but the way they want to be seen by others. Gender is chosen by the participant as well as skin color, texture—even whether to be portrayed as a human, an animal or a new form of life. This characteristic of immersive environments adds richness and puts a new dimension on social presence: learners can project selective personal characteristics to the group often in a very creative fashion.

MUVE's allow users to gesture, smile, dance, and in many other ways express body language through their avatars' movements. Antonijevic subdivides non-verbal communication into user generated and computer generated non-verbal communication. In a recent observation study conducted in Second Life, the preliminary results show a correlation between enhanced interaction and user generated non verbal communication. Antonijevic goes on to note that "proxemic behavior observed in SL had an important communicative function, analogous to the role of proxemic cues in face-to-face interaction. Further, this type of non-verbal communication was successfully integrated with co-occurring textual discourse, enabling creation of an enriched computer mediated communication environment" [18].

Avatar use blurs the boundary between self and object. The avatar is a digital representation of a person, and the interaction, though mediated, is real: it is not the avatars' interacting but rather people interacting with people through their avatars. Lander echoes Antonijevic's comments: the real becomes shareable and interaction possibilities multiply [19]. As alluded to above, an avatar does not have to be human nor should an avatar necessarily be expected to do normal things. Wheeler and Nistor noted when describing the effects of anonymity in online culture that the more bizarre the appearance of the avatar the more bizarre the behavior [20]. This emergent behavior adds to the aforementioned salience. Dis-inhibition can increase sociability and provides new avenues for those whose actions are inhibited due to shyness or physical disability in real environments. How does this very novel form of social presence affect learning (or teaching) in immersive environments?

The actions and resulting teaching presence in MUVEs is expanded beyond classroom or other forms of online education because the teacher often is forced to act as the students' guide in this unique, changeable and often unfamiliar context. In addition, the novelty and compelling social attractiveness of MUVE's may distract learners. Arbaugh found that teachers must push students to think intellectually on the topic being taught and not be swayed or distracted by the environment itself [21].

There are a number of immersive environments available for use by educators. ActiveWorlds is used by Dede for the famed River City Project [22] and the Open Croquet (http://www.opencroquet.org) foundation offers an open source tool set for creating one's own MUVE. The MUVE that is the most

popular today with over 5.6 million participants is Second Life [23]. Approximately 110 colleges or universities throughout the real world have a presence in Second Life [24]. These sites are used for a variety of applications—many experimental—including social gathering space, virtual representation of physical campus, institutional exposure and marketing, concert and recital space, and for teaching and learning. Academic subjects being taught include freshman composition, archeology, law, physics and research methods.

As Johnson points out, there are both advantages and disadvantages of using Second Life as an education tool yet many immersive environment educators focus only on the advantages. He notes that the main disadvantage of using Second Life for educational purposes are technological barriers: some students or educators cannot use Second life due to system requirements of the Second Life client and limited connectivity by some users—Second Life requires broadband connectivity [25]. Voice interaction has recently been added to Second Life; however it is difficult to use with large numbers and requires additional technical skills and equipment to operate effectively. Finally, and perhaps of most concern pedagogically, is the potential challenge of transferring and applying knowledge gained in MUVEs to the real world where demonstration and practice of new skills and knowledge is most productivity realized.

Although there are some purely virtual classes conducted in MUVE's many academic institutions use a blended approach: the class meets both face to face and in a MUVE. One teaching strategy in this blended approach is to use the virtual environment as an opportunity to apply knowledge that is learned in the face to face session. It is assumed that the MUVE creates a public environment that is more like a real world environment than the institutional context of formal classroom learning. For example, the blended learning approach of Harvard Law course called "CyberOne: law in the court of public opinion" allows learners to practice their argumentation skills to influence public opinion. The objective of this course is to teach prospective lawyers about the power of presenting persuasive arguments in the public domain [26]. The Harvard Law students carry out a semester long small group project in Second Life with extension school students in which, together as a group, they develop legal arguments for a moot court in Second Life (see figure 2).

Figure 2. Harvard Law School in Second Life

II. METHOD

The research that is described in this paper follows Bannan-Ritland's Integrative Learning Design framework [27]. The first stage of this research model is informed exploration–followed by enactment, local impact evaluation and broader impact evaluation [27]. Within the informed exploration stage an important research method is observation and study of the relevant educational context. We conducted an observational study using a purposive sample selection of educational events occurring in Second Life. The purposes of our observations were twofold. The first was to see if cognitive, social and teaching presences, as defined by Garrison et al's categories were recognizable in synchronous MUVE educational events. The second purpose was to determine if the indicators for each of these presences were accurate and relevant in the MUVE setting or if new or additional MUVE indicators should be identified. The overall purpose for these observations was to determine if the community of inquiry model could be used as a theoretical basis to construct an evaluation rubric for educational events in immersive environments.

The observations took place between February and April of 2007 and were conducted in the Second Life MUVE. The criteria for selecting the MUVE learning events for this study included openness to the public and a subject audience aimed at formal, post secondary level education. We also sought out diversity in learning; the size of the learning group, media and class distribution were all factors when selecting a sample MUVE learning event. The primary method of identifying potential learning events was done by monitoring the Second Life Education List--a high volume email list of interested educators. The Second Life MUVE was the study platform chosen because its client software is free to download; it currently has the largest number of active users; and there were numerous educational opportunities for study.

The six learning events were observed by a recent graduate of Athabasca University's Masters in Distance Education degree knowledgeable about the community of inquiry and its indicators. The observer's avatar during the observations was non-assuming and neutral. The observer did not overtly identify himself and was generally a passive observer. The duration for the observations was between thirty and sixty minutes. A variety of educational presentations and interaction activities were observed in the MUVE including video streaming, synchronous slide sharing, synchronous text chat with no sound, and synchronous sessions with sound. The topics also varied but all were post-secondary academic content and all events were open to the public or the instructor granted permission to the observer to attend. To note whether a category was recognizable the observer developed an observation schedule based on the community of inquiry model. These observation schedules are available on the Canadian Institute of Distance Education Research web site (http://cider.athabascau.ca).

Unlike early work by Garrison et al. we searched for evidence of broader categories of the three components of the community of inquiry, rather than detailed indicators. Garrison has noted the challenges of quantitatively analyzing text at the indicator level and questions if this level of detail is needed or enhances research validity [13]. It undoubtedly increases the challenges of reliability coding [29] when one seeks to identify all the possible indicators of complex and often projective constructs such as these three "presences." Thus, this initial work is aimed at developing more qualitative indices of presence that can be used in heuristic fashion to assess the presence of an effective community of inquiry.

III. RESULTS

A. Observation #1: Immersive Environment Pedagogy Discussion

This educational event was a workshop for educators led by an experienced MUVE educator. There were approximately ten people in attendance. The topic of the lesson was pedagogical techniques in Second Life. The location was changed at the last moment so the observer was a bit late—and this was one lesson from this observation: the teacher or his agent must ensure that the students know how to get to class. It is easy for new users to become lost and disorientated despite the navigational tools built into Second Life. Without adequate knowledge and experience, new users can be overwhelmed and continuously distracted by the rich and often disconcerting graphics, sounds and activities in this MUVE.

The observer was greeted by the instructor and answered the observer's question about how to sit down. The instructional approach was discussion group and the session was completely text based. There was a chat facilitation system—a method where a question or a comment from the class went directly to the instructor who then went through the questions which were discussed as a group—and this approach seemed to work well because it was well organized and it generated robust discussion.

We were impressed with the instructors' teaching style because it was organized and very interactive with the class. The instructor also used innovative teaching tools from his “inventory.” Each avatar has an inventory that contains reusable resources and the teacher used these resources as teaching tools. An example of this occurring is when a student in the group asked what the smallest “sim” you could buy and suddenly the floor lit up with the exact size the instructor was talking about. The instructor also produced a map of the Second Life ‘world’ and showed the class where they were. Both resources contributed significantly to teaching presence because they demonstrated teacher’s capacity to use the medium effectively, helped set the climate for learning, helped orientate study and resolved contextual confusion. The instructor used affective behaviors including use of humor, solicited student comments and expressed agreement—all indicators of social presence.

A second event that demonstrated enhanced social presence was an Instant Message session—or a private chat—with an avatar who in real life is a college instructor from the eastern United States. The observer and this avatar chatted about academic topics, and the self-exposure in instant messaging interaction created a bond of immediacy. A drawback to private instant messaging in this MUVE environment is that the multi-tasking distracted attention and thus reduced teacher presence because the observer was busy instant messaging. On the positive side, however, the dialogue resulted in increased engagement, triggering of relevant questions and exploration, all crucial components of cognitive presence.

There was also evidence of emergent and somewhat disruptive behavior in this observation: a giant squid sat down and was immediately asked to “reduce!” by the instructor, shown below in figure 3.

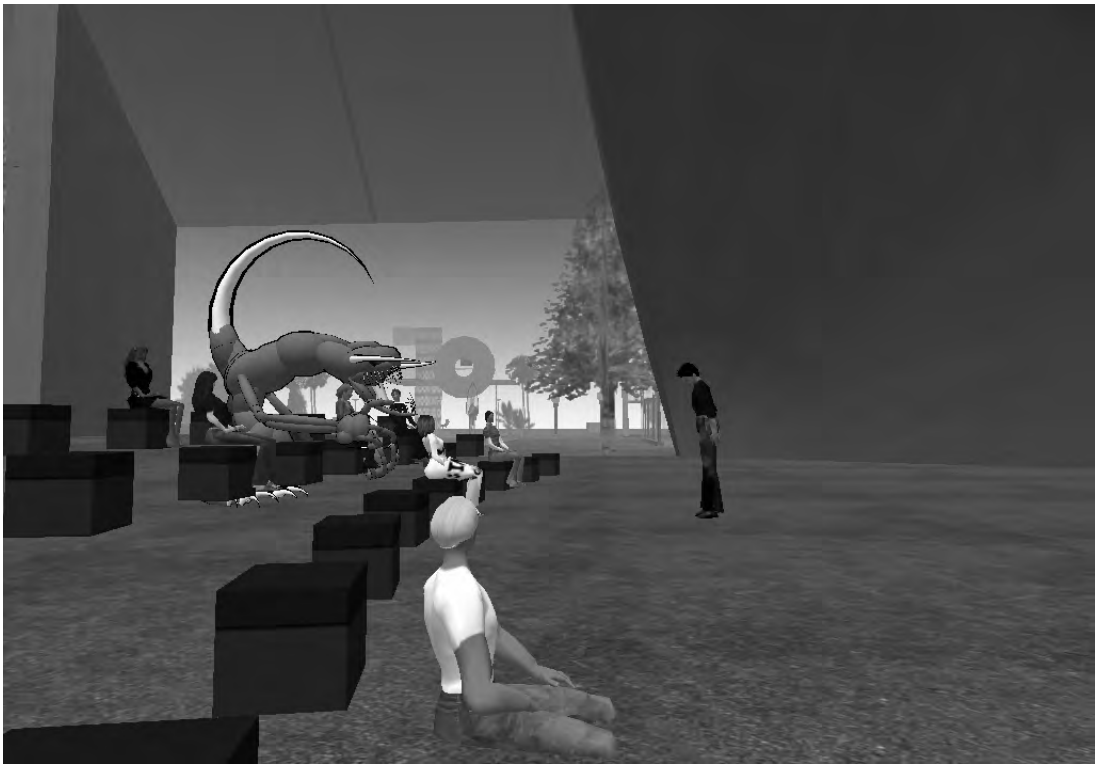

Figure 3. Emergent Behavior

The instructor's directive action was indicative again of strong teaching presence as he helped retain the climate for learning, injected knowledge of the subject domain and responded to technical concerns However, a factor which decreased teaching presence very significantly was the sudden disappearance of the instructor when his Internet connection failed. Fortunately, he reappeared in about five minutes and was able to continue with the class.

The importance of technical help underscores the need for teaching presence to include technical support. Berge noted technical support was one of three major functions of the teacher in an online environment [30]. However, in the Community of Inquiry model this technical support was subsumed as a more minor role as an indicator of direct instruction, possible because technical support was even in 1999 becoming routine or handled by technical staff and thus not the responsibility of the teacher. Obviously the novelty and complexity of MUVE's makes this assumption questionable. Secondly, use of auxiliary media (Instant Messaging, Skype, etc.) by subsets of the class was not considered in the development of the Community of Inquiry.

It seems that an additional indicator of effective teaching presence in MUVE's is control of these side channels. However, as teachers even in face-to-face contexts are finding, such control is challenging and it is unclear if side talk conversation impairs or enhances learning [31]. Finally, teacher presence seems to be enhanced by skillful simultaneous use of MUVE multimedia resources.

Based on the observation schedule, this sample MUVE learning event scored high in cognitive presence, high in teaching presence and medium in social presence.

B. Observation #2: Guest Speaker Simulcast In a University Journalism Class

The second observation was organized by a Canadian University professor who invited guests to attend a live session where a seasoned journalist was a guest speaker for an undergraduate journalism class. The technology was streamed audio and video. The observer used a provided Slurl (Second Life URL) that allowed users to 'teleport' directly to the auditorium where the educational event was taking place. This navigational aide was helpful to the observer and could be categorized as an additional logistics factor of teaching presence. The observer had to adjust some preferences on the Second Life client and once this was done, the observer was looking and listening at a screen with a person speaking to students in a traditional classroom at the University. In this observation, Second Life served as a distributed location increasing access to the event for those not able to attend in person.

This observation had a different feel than the chat-based observation. The observer felt detached from the event because it seemed like the speaker was concentrating on the 'real people' in front of him and the virtual participants were treated somewhat like flies on the wall. This led to decreased group cohesion which negatively impacted social presence. One method of rectifying this decreased group cohesion could have been to acknowledge and attempt interaction with the Second Life learners. The observer was greeted, however, by another avatar when he arrived in the auditorium so this increased the social presence slightly.

It was interesting to note that Second Life students all had different technical experiences based on their computer hardware. Some could hear audio, some could not. Some saw a picture upside down, some did not. These differences illustrate an important difference between analyzing community of inquiry in text based computer mediated communication and more graphic immersive environments: the technical issues in simple text based asynchronous communications are not nearly as invasive. Multi User Virtual Environments demand much higher bandwidth and computing power on the user's desk, each of which has potential to reduce access, a fundamental goal of any form of education.

This observation offered no possible additions to a MUVE based Community of Inquiry except some caveats: if the education event is a simulcast with a live speaker addressing a face-to-face audience and a MUVE audience, the speaker must acknowledge the different contexts of the participants. Non support from the simulcast instructor decreases social presence and teaching presence significantly when instruction is directed exclusively at the physically present class. A second caveat is not to assume that everyone will experience the virtual environment in the same way due to variations in technical and communication capacity. This of course complicates an evaluation of this learning context.

Based on the observations, cognitive presence was rated "medium", teaching presence was rated "low" and social presence was rated "low".

C. Observation #3: Guest Speaker Simulcast in a University Education Class

The third observation of an educational event in Second Life was similar to observation #2—a simulcast of a guest speaker. This event was sponsored by a U.S. university and included shared power point slides and audio in Second Life. The guest speaker was experienced and well respected in the Second Life educational community and obviously supportive of the educational use of MUVEs. She acknowledged the Second Life participants and had a colleague login as her avatar. This brought new meaning to teacher presence—she *was* in two places at once: a multimedia presentation of her real self as well as an avatar presentation of her second life avatar. The dual roles seemed to significantly reinforce teaching presence.

The Second Life space for this observation was an open public space: there were two screens and a podium in the front. The observer logged in early because there are a maximum number of avatars allowed in a given space and as sometimes in a popular event avatars are turned away. The observer noticed later that there was an "overflow" room at another Second Life location, which again points to adding a logistics indicator for teaching presence. Based on the chat history, people seemed to know each other—the buzz was similar to pre class chatter (spontaneous interaction indicating social presence), but when the class finally got started there was not too much chat which could indicate that the Second Life students were paying attention. There was considerable international representation in this educational event—people from Slovenia, USA and someone who spoke mostly French indicating the presence of both linguistic freedom and potential language barriers.

The Second Life students could not hear sound in the beginning before class started and the observer sensed this caused some stress among Second Life attendees. Once we could hear, the sound was of good quality. The two screens were also used effectively although there was some lag in the slides.

Social presence seemed lacking—I was not greeted by anyone and no one initiated private Instant Messaging. Even though there was a teacher avatar present in Second Life any group cohesiveness between Real Life class and the Second Life class was not noticeable: we again got the impression that presenter was more focused on the physically present class. There were illustrations of affective responses during the Question & Answer session—an "Amen" as well as salient use of emoticons by avatars.

The information was presented in a way that reflected good instructional design principles, and this contributed to teaching presence. The observer asked a question via chat, and it was responded to without delay. Other questions were also handled effectively. This also led to increased teacher presence. Finally, the presenter's slides were available to use as a resource for both real life and Second Life classes.

Logistical problems in this largest gathering of our observations were surprisingly lacking. The organizers should have done an audio test well before the class started; however, as it was, Second Life students heard the audio of the not so confident sounding technical staff which was not too reassuring and perhaps added to the stress level. There was an avatar from the host university in Second Life but he or she was not identified, so the observer could not identify this person. Other teaching presence deficiencies include the failure of the presentation to start on time, and lack of clarity about where the class was situated in Second Life.

The observer perceived that learning about the material being presented had occurred but higher levels of cognitive presence (community exploration, integration and application) in this Second Life event seemed lacking. There was no opportunity for assessment and little opportunity for the participants to engage in critical inquiry.

There was some emergent behavior—but no reaction from the Second Life class. At one point in the presentation a small avatar jumped up on to the screen displaying the PowerPoint—yet no one asked him to leave or acknowledged his presence. There were also avatars that wandered in and asked what the event was and they were answered politely and invited to stay. The avatars in this Second Life educational event were also quite normal looking—no dragon heads or tails indicating that for formal learning it may be more important to exercise one's real life in a virtual environment than to develop a second fantasy life.

Based on the observations, cognitive presence was rated “low”, teaching presence was rated “medium” and social presence was rated “low”.

D. Observation #4: First Year English Composition Description

The fourth observation in this exploratory study was a blended freshman composition class of small state university located in the U.S. The group met two nights a week: once in a traditional classroom and once in Second Life. This school’s Second Life class meets in a gazebo like structure and the discussion was lively and well facilitated. The observer saw evidence of every category of cognitive, social and teaching presence.

Figure 4. Freshman Comp in Second Life

The teaching style was quite Socratic in nature and the instructor asked several questions of her students to encourage critical thinking. Example questions include “What kind of sources did you find most helpful?” and “How is it hard? Where does the pressure come from?” The first part of this class was a discussion and then the group went to work on a group project. The observer checked with the instructor the next day and she noted “Last night may have seemed very chaotic but that's exactly what I intended. The students are working on a large building project and have been resistant to my efforts to make them split up and organize the work. I think that last night they finally realized that it wasn't going to work if they didn't get organized. On Tuesday night in our F2F class I fully anticipate that they'll break down and split up the tasks, finally!” (R. McKerlich, personal communication, March 30, 2007).

In terms of social presence the observer noted considerable open communication, including self-disclosure about their real lives. One student noted “I'm back—I just put dinner on the table for my kids,” and the rest of the group was interested. There was also sharing of stories about how their week had been going. There were some unusual avatars and many were welcomed with a personal greeting—an indicator of open communication—and there was considerable affectiveness, interaction and group cohesion. Immediacy was also present.

As mentioned above, there was exemplary teaching presence. The instructor directed conversation and probed deeper: “What did you learn?” She offered advice “Good to check your facts first,” and also identified barriers to participation and remediation.

Based on the observations, cognitive presence was rated “high”, teaching presence was rated “high” and social presence was rated “high”

E. Observation #5: Weather Island

The fifth observation was different from the first presentations in that it was a simulation but the observer wanted to see how an educational event of this type would fare on the observation checklist. The event was on “Weather Island,” a Second Life presence for the weather channel and its objectives were to offer a learning experience for people about extreme weather. There was some teaching presence because as the observer’s avatar crossed into a zone he was given audio instruction on what to do. Objectives were also stated—“to learn about extreme weather.” There was also a helpful note to check preferences for a better experience which in the observer's opinion, points once more to the importance of logistics. As the observer walked towards the surf station he heard the sound of heavy surf and learned more about the locale that it represented.

There was an opportunity to experience the big waves—a free surfboard was offered—but it was not clear how to ride the surfboard. The observer did, however, experience the sound and feel of big waves so that sensation offered a new learning experience. The observer also experienced his first computer crash while using Second Life—confirming a technological barrier that seems to plague MUVEs.

The observer did not see anyone to interact with so social presence was non-existent and cognitive presence was also lacking for reasons noted above. The overall rating is not high for any of the presences—but it is a simulation that focuses exclusively on learner-content interaction and thus may have different design constraints, assessment criteria and expected outcome. One can hardly expect the development of a community of inquiry from a single learner interacting with content- though if done well significant learning may still result [32].

Based on the observations, cognitive presence was rated “low”, teaching presence was rated “low” and social presence was rated “low”.

IV. DISCUSSION

The qualitative observations noted above constitute a component piece of the informed exploration stage of Bannan-Ritland’s Integrative Learning Design [28]. The purpose of these observations was to determine if the community of inquiry model, developed on the basis of text based computer mediated communication, was recognizable in a MUVE learning environment. A secondary purpose was to determine if other MUVE indicators are needed to supplement the existing indicators in the community of inquiry model. The overall purpose was to determine if the Community of Inquiry can be used as a framework for evaluating educational events in immersive environments.

A. Is the Community of Inquiry Recognizable in a Muve Learning Environment?

The observer was indeed able to observe cognitive, social and teaching presence indicators in a variety of learning events that took place in an immersive environment. Based on the observation schedule and the experience of the observer it was clear that immersive environments for learning offer enhanced presence. It seems that the ‘physical’ presence of students and teacher configured as avatars added to the immersive

environment educational experience.

Related to this discovery, we also learned that educational experiences, when assessed against community of inquiry indicators, offer varying degrees of overall effectiveness in terms of each educational element. For example, observation #4, freshman composition, scored highly on social presence, teaching presence and cognitive presence and could be regarded as an example of a good educational experience in a MUVE. Observation #2, a streamed key note lecture, scored medium on cognitive presence but low on social presence and teaching presence. As professional educators we can learn from both. The community of inquiry model thus serves well as an evaluation model for assessing MUVE educational contexts: cognitive, social and teaching presences are the standards and the categories are the criteria.

We also observed that some learning designs yield better educational results than others. This is not surprising given the importance of the learning design relative to the use of the technology itself [33]. For example, audio and slide share seem to provide a better pedagogical solution than streaming video and audio because it is easier for the learner to see the slides and the movement of the presenter and streamed audience can be distracting—especially if it is of low quality.

Finally, we learned that an observer could rarely see all community of inquiry indicators in every educational event—especially those in which learning is designed for an individual experience such as the weather simulation demonstrated. The reason for observing the simulation was to determine if the Multi User Virtual Environment Education Evaluation Tool (MUVEEET) observation checklist (see appendix) would be effective for evaluating every educational event in a MUVE. It is not—and while the MUVE simulation observation checklist is an interesting first step, considerable further systematic observation and analysis is required.

B. Are New Indicators Required if the Community of Inquiry is Used as a Base Rubric for Evaluating MUVE Learning Environments?

We found that some elements of multi-user virtual environments *enhance* the existing categories. For example, participants' reactions to emergent or bizarre behavior are excellent tests of the open communication category of social presence. Also, if a learning event is simulcast in two different places—one virtual and one real—then this puts constraints on group cohesiveness if the instructor is not careful to address and involve both contexts.

The original definition of social presence from the COI model is "the ability of participants…. to project their personal characteristics into the community, thereby presenting themselves to the other participants as 'real people'" [1, p91.] Obviously, avatars are not 'real people' and many users take advantage of the creative construction tools available to create avatar images of themselves that are unlike their real selves—for example gender swapping or even adding animal or mythical extensions to their avatars. Thus, extensions of categories demonstrating social presence would include the richer capacity to express body language through avatar construction, gestures and voice. It seems likely that social presence is more profoundly affected in MUVE environments in comparison to the asynchronous text environment. However, these enhanced social presence affordances will likely lead (at least novice users) to embarrassments and breach of cultural norms, as much as they enhance learners' comfort and ease of participation in a MUVE based COI. Thus, considerable attention needs to be placed on supporting and in some cases constraining social presence if a learning environment encourages learners to act as their real selves. However, the definition of social presence is itself challenged in these contexts, as defining what is 'real' remains an ontological challenge for many users.

We also note the enhanced importance of logistics, user competence and navigational skill needed to operate effectively in immersive environments. Do students know how to get to class? Can they hear? See? Do they have the knowledge to navigate and complete tasks related to their learning? It seems worthwhile to add efforts by teacher to reduce or remove logistic concerns as MUVE criteria of teaching presence. Another criteria addition to teaching presence is the extent to which the teacher uses the many and diverse set of tools available to him or her. For example, in the first observation the very skillful instructor used many innovative tools for the benefit of his class—including the showing of a huge map, allowing the class to visualize their location in the immersive environment. These tools or teaching/learning objects seem to add pedagogical value to instruction in immersive environments.

Cognitive presence is critical in any learning event, and some categories could be added within the context of MUVE criteria for a COI. Is the MUVE a stand-alone educational environment, or is it an addition to more traditional online tools such as learning management systems and blogs? Learning technologists are working to integrate MUVEs with other educational tools such as Sloodle (Second Life + Moodle) [33]. The integration of a learning management system with a MUVE provides another venue for the student to demonstrate critical thinking. It may not be obvious by observation if a student in Second Life comprehends the material under discussion or presentation, but this can be assessed using quizzes or postings on a course management system. A final MUVE criterion is to determine if there are unique assessment opportunities and means to demonstrate effective critical thinking. For example integration or applications of knowledge into activities or artifacts created in the MUVE are indicators of cognitive presence.

C. Could Community of Inquiry Be Used as a Base Rubric for Evaluating Educational Events in Immersive Environments?

Based on the data contained in the observation schedules and subsequent discussion, we believe that the community of inquiry can be used as a tool to describe and assess educational experiences and contexts in MUVEs. We conclude that the essential constructs of the community of inquiry model apply to immersive environments that expand the modes of communication to include real time text, visual and verbal cues. We further suggest that developing this kind of tool aligns with the original mandate of the Community of Inquiry: to evaluate educational experience in computer mediated contexts [1].

The observations described above reveal that an educational event in an immersive environment may have varying degrees of social, teaching and cognitive presence. We have made the first steps at developing a tool, shown in Appendix 1, which includes values for each element of the Community of Inquiry that a trained, non-biased evaluator could assign. The end result would be a MUVEEET score which could quantify the quality of an educational event in an immersive environment. This MUVEEET score could help earn a place for immersive environments in the education technology tool chest.

Drawbacks to use of the proposed tool include the requirement for synchronous use during an educational event. Real time observation is required because visual and verbal cues are used in immersive environments and part of the value of these environments is the immersion experience itself. With the use of screen recording tools this drawback could be minimized to some extent. Benefits of the proposed evaluation tool include its utility and it currency in meeting emerging needs in the educational community.

This study is a preliminary work that does not delve deeply into the methodological issues needed to validate a quantitative instrument; neither does it delve deeply into the phenomenological experience of

learners or teachers in MUVE contexts. Nonetheless, we believe the study it is a useful first step that helps us understand learning and teaching in these emergent contexts. The following questions need to be addressed to validate the MUVE education evaluation tool:

If the categories above can be applied to immersive environments, is it possible (or even a good idea) to assign values to each indicator? Should there be weighted values or all the same?

What is the unit of analysis? —A time based function such as so many minutes of MUVE activity, or the whole event? Or a whole series of events?

How important is it for multi-coder reliability to be established, given the subjective nature of the experience of MUVE learning?

How does one establish validity for the MUVEET, especially since learners may be experiencing any of the three presences, without actually moving their avatars or interacting with the class?

Does the MUVEEET provide meaningful guidelines or assessments for both researchers and practitioners working in immersive environments?

V. CONCLUSION

Based on Bannan-Ritland's Integrative Learning Design Model [28] one component of the informed exploration stage has been completed by observing five diverse educational events in a Multi User Virtual Environment. Most of the key elements of the community of inquiry model were recognizable and the value of an evaluation rubric based on the COI model was noted. This proposed MUUVET instrument applies Garrison, Anderson & Archer's Community of Inquiry model [1] to immersive environments for the purpose of evaluating educational events. The MUVEEET is based on sound academic theory and can help innovative educators justify an immersive environment educational event. The instrument needs further development, and work on its validity and reliability assessment; nonetheless it offers a first step towards evaluating this emerging educational context.

Just as innovative educators were once excited about the possibilities of text-based computer mediated communication there is great excitement about immersive environments. The Community of Inquiry model could serve both and become a standard for assessing excellence in distance education regardless of what technology is used from the educator's tool chest.

VI. APPENDIX: MULTI USER VIRTUAL ENVIRONMENT EDUCATION EVALUATION TOOL (MUVEET)

Date	
Event	
Topic	
MUVE	
Evaluator	

Cognitive Presence

Categories	Observed	Example
Triggering Event		
Exploration		
Integration		
Resolution		

Muve Criteria	Observed	Example
Integrated Education Tools		
Use of Enhance Multimedia		
Mediated Assessment		

Teaching Presence

Categories	Observed	Example
Design & Organization		
Facilitating Discourse		
Direct Instruction		

Muve Criteria	Observed	Example
Logistical Focus		
Side Channel Control		
Teacher Representation		

Social Presence

Categories	Observed	Example
Effective Expression		
Open Communication		
Group Cohesion		

Muve Criteria	Observed	Example
Do other avatars support emotive expression?		
Reference to Real life among avatars		
Initiation of after class activities		

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VIII. ABOUT THE AUTHOR(S)

Ross McKerlich is a graduate of the Masters in Distance Education program at Athabasca University and owns Centerboard Strategic Learning, an e-learning consulting company. Email ross@centerboard.ca.

Terry Anderson is a professor and Canada Research Chair in Distance Education at Athabasca University – Canada's Open University. Email terrya@athabascau.ca.

STUDENT PERCEPTIONS OF FACE-TO-FACE AND ONLINE DISCUSSIONS: THE ADVANTAGE GOES TO . . .

Dr. Katrina A. Meyer
Associate Professor of Higher and Adult Education
The University of Memphis

ABSTRACT

Thirteen students in a graduate-level course on Historical and Policy Perspectives in Higher Education held face-to-face and online discussions on five controversial topics: Diversity, Academic Freedom, Political Tolerance, Affirmative Action, and Gender. Students read materials on each topic and generated questions for discussion that were categorized by Bloom's taxonomy so that the level of questions in the two discussion settings would be closely parallel. Upon completion of each discussion, they answered questions that addressed depth and length of the discussion, ability to remember, and a self-assessment of how the student learned. Students' assessments show a consistent preference for the face-to-face discussion but a small number of students preferred the online setting. However, what is perhaps more interesting is a minority of approximately one-third of the students who perceived no difference between the settings, or that the two settings were perhaps complementary.

KEY WORDS

Blended Learning, Face-to-Face and Online Discussions

I. INTRODUCTION

Within the past year, there has been increased interest in defining and studying the phenomenon of blended learning. Sloan-C has created a web site on blended learning (http://www.blendedteaching.org/) and published a compilation of research studies [1] (which includes an intriguing theoretical approach [2] for future research), and there have been other books and articles [3, 4, 5] on how to blend online and traditional methods appropriately and what may be the advantages and disadvantages of the format [6]. This interest is overdue, and indicates an interest on the part of faculty and researchers to identify what blended learning is and how to describe it, but more importantly, to determine how faculty can plan the face-to-face and online instructional components so that each works best for student learning.

But to be able to plan wisely for what works best in which part of the blended class, we need a better understanding of the differences—advantages as well as disadvantages—of face-to-face and online components of a program or course. Specifically, this research focuses on a narrow comparison of face-to-face and online discussions that have been designed to be closely similar in topic and level of "triggering questions" [7]. This was done to ensure that the study could be a more direct comparison of the two settings rather than inadvertently including too many variables that cannot be controlled or isolated such as when courses or programs are compared.

II. LITERATURE

A. Face-to-Face and Online Discussions

Research on discussions held in the classroom has a long and fruitful history. Discussion has long been a favorite tool of instructors and understanding what works and what does not has depended on theories in psychology, sociology, and social psychology, among others. Research into small groups [8] stresses the complexity and adaptability of these groups as well as their dynamic qualities. It is important to see such groups as complex systems because complexity adds richness to the analysis of what occurs in a discussion, which depends on factors external to the group, relationships between or among group members, and internal psychological states of the individual members. Newer theories for studying group communication and discussions have been proposed, including functional, symbolic convergence, structuration, and feminist theories, cultural diversity perspectives, and dialectic theory [9]. Perhaps every theory that addresses the individual's psychology may be usefully applied to analyzing discussions. New approaches to studying classroom discussions include ethnographic studies [10] as well as mapping, charting, and diagramming activities, relationships, and content of contributions [11].

Research into online discussions has become an exploding field of endeavor. This may be due in large part because online discussions produce a written transcript, which can be analyzed using multiple approaches, and because they are widely used to encourage student-student and student-faculty interaction. Meyer [12] has reviewed the different purposes of analyzing online discussions, from faculty conducting research on theories of online learning to assessing student learning to an instructor wishing to learn how to better conduct online discussions and determine what improvements should be made for future classes. Useful theories for analyzing online discussions include the community of inquiry model [7], transactional distance [13], transactional theory [14], constructivist learning theory [15], computer-supported cooperative work [16], collaborative learning [17,18], and online learning communities [19].

Many research studies compare face-to-face and online settings by using theories from face-to-face classrooms. Curtis and Lawson [20] applied characteristics of collaborative face-to-face learning to the study of online learning; Swan [21] explored the relationship of "verbal immediacy" in research on face-to-face communications to online communications; Picciano [22] explored the non-linear nature of asynchronous discussions which can branch into numerous "threads" rather than follow the more linear thread of face-to-face discussions; Meyer [23,24] applied theories from the pre-Internet world to analyze online communications. The next level of comparison one can find in the literature is when students are asked to compare online discussions held in class to previous face-to-face conversations which are not defined nor may be similar to the online discussions. Tiene [25] found that graduate students reacted positively to their online discussions, although they still preferred the face-to-face setting; these students noted that the online discussions were a valuable addition to the class and not a substitution for face-to-face discussion. Meyer [26] and An and Frick [27] produced similar results when students compared their online discussions to their unspecified earlier experience with face-to-face discussions. The next level of comparison is when an online course is compared to a face-to-face one. This "comparison study" model may not be particularly well designed and has resulted in many "no significant difference" findings (see http://www.nosignificantdifference.org). Both Neuhauser [28] and Johnson et al. [29] compared face-to-face and online courses and found no difference in student learning outcomes. On the other hand, Suthers et al. [30] focused more narrowly on comparing the roles of verbal and body gestures in collaboration in the two settings. Not surprisingly, face-to-face students used gestures to point to or indicate words or things under discussion. Online students were more likely to use words to do this and to focus on more recent material in the chatroom rather than all material available. In a comparison of online and blended learning, an interaction between the communication setting and type of task was found [31]. Sharing knowledge and coming to a joint solution was achieved better in a synchronous setting, and learners who

worked together face-to-face and online had a more coherent experience. Results such as these confirm that it is not simply the setting that matters, but the match of task with the setting that influences learning.

What is missing in much of the research so far is a more direct comparison of face-to-face and online discussions. Based on earlier literature, what might we expect from such a comparison? Two intriguing possibilities can be found in the early work of Etzioni and Etzioni [32] and Hammond [33]. Hammond [33] concluded that there was a case to be made for multimodal learning including face-to-face mixed with asynchronous learning. Having said this, it is still not clear to the individual wanting to design good blended learning classes about what activities, content, or learning objectives would go best in which setting. Etzioni and Etzioni [32] concluded that "computer-mediated and face-to-face communities each have their own advantages as well as their own weaknesses." In other words, we should be investigating what each setting can do that the other cannot, or cannot do as well. These writers seem to be implying that the two settings are different in some manner, and these differences may be complementary. These differences—and the nature of the differences—need to be explored in greater detail.

B. Blended Learning

The interest in online discussions is perhaps the result of the rapid expansion of online learning. Enrollments in online courses in fall 2003 were 1.9 million students, having grown 20% from fall 2002 [34], which grew by to 3.2 million students in Fall 2005 [35]. However, there is no current estimate of the number of students enrolled in blended courses, that is, courses that blend both face-to-face and online components. In fact, in recent research [35] estimating the penetration of blended learning courses and programs at U.S. higher education institutions, approximately 80% of public institutions offered at least one blended learning course, but the institutions could not identify how many courses were blended. In other words, administrators do not know how individual courses may be designed nor can they say how much blended learning is occurring at their institutions.

In order to provide some precision to the term of "blended learning," the Sloan-C Consortium adopted the following definition:

1. Courses that integrate online with traditional face-to-face class activities in a planned, pedagogically valuable manner; and
2. Where a portion (institutionally defined) of face-to-face time is replaced by online activity [37].

What is interesting about this definition is that it presumes that instructors will know which activities should be done in which setting (face-to-face or online), which activities may go best in which setting, and why. For discussions specifically, faculty need much better information about what differences exist between the two settings, or if no differences are discernable. This research is an attempt to directly compare the two discussion settings—face-to-face and online—using the perceptions of graduate students engaged in both types of discussions.

An earlier study [38] using the same methodology as in this study, asked graduate students to directly compare face-to-face and online discussions. In this research, students assessed their comfort, honesty, concern for others' feelings, similarity of feelings to others, and willingness to disagree and then compared the face-to-face and online discussions on these measures. Students indicated that some topics did elicit feelings of discomfort, concern for others' feelings, and lessened their willingness to disagree in the face-to-face discussions. However, despite these feelings, the majority of students continued to prefer the face-to-face discussions (which is similar to earlier findings [25, 26, 27]). Online discussions were

valued to a lesser extent, but a consistent minority of students was more comfortable in that setting. The age and race of the student also created differences in responses, wherein older and African-American students appeared more comfortable with the controversial topics covered in the discussion. The current study will push the analysis further by asking different questions of a new group of graduate students as they complete parallel face-to-face and online discussions.

C. Research Question

This study was designed to address the general question, "Are there differences in student learning in face-to-face and online discussions?" The specific research question is "Do students perceive face-to-face and online discussions differently in terms of a) depth of learning, b) appropriate length for learning, c) ability to remember details and "who said what," d) where they learned more or better?" Answers to this question may help faculty determine when to schedule face-to-face discussions or online discussions and how to use the two discussion settings to achieve student learning for all.

III. METHODOLOGY

A. Research Method

In late summer 2005, approval was gained from the University of Memphis human subjects review board for this study. In fall 2006 during a graduate-level class on Historical and Policy Perspectives of Higher Education, the 13 enrolled students were asked to prepare for and participate in a series of discussions on controversial subjects in higher education. The controversial subjects were 1) Diversity, 2) Academic Freedom, 3) Political Tolerance, 4) Affirmative Action, and 5) Gender. These subjects were chosen because they are important policy issues in higher education and because students invariably have different views about them and a desire to discuss them in some depth. The instructor regularly modeled an open approach to discussions of controversial matter in the early weeks of the course; for example, the class tracked the changing definition of "diversity" in different historical eras in American higher education and analyzed data on the changing composition of higher education as regards class, race, and gender.

The instructor introduced the first of the controversial discussions in week six of a 15-week semester after having given the students several weeks to become familiar with the instructor and their fellow students. While the topics may have been controversial, the intent was not to make the discussions embarrassing or otherwise difficult for the students.

Students prepared for the discussions by reading four to five websites with research articles or data on the topic prior to coming to class for the face-to-face discussion. The topic of diversity focused on data about minorities in higher education as students, graduates, faculty, and institutional leaders. The discussion about academic freedom focused on the 1940 American Association of University Professors (AAUP) Statement on Academic Freedom, the Ward Churchill controversy, and articles on academic freedom after September 11th. The discussion about political tolerance focused on readings about the Student Bill of Rights and liberal and conservative points of view on higher education. The topic of affirmative action required a reading of the Michigan Supreme Court decisions and analyses of different approaches to college admissions not based on race. Lastly, the readings about gender focused on various issues affecting female students and faculty, including sexual harassment and family-friendly work policies.

Based on their readings, students developed questions they felt would be worthwhile discussing in class with their peers and wrote them on 4 x 6 note cards. This was done to maximize student interest in the

discussion, and these questions were often better than those the instructor might have proposed. The instructor then categorized the questions into Bloom's taxonomy, recently updated by Anderson and Krathwohl [39]. These new categories reverse the two highest levels so that the taxonomy is (from lowest level to highest): know, understand, apply, analyze, evaluate, and create. Student questions were separated into two groups (for the two discussion settings), so that each group would include questions that required students to know, understand, apply, analyze, evaluate, or create. This was done in an attempt to make the two discussions as similar as possible in the level of questions asked although exact questions were clearly different. One group of questions was posed in class, one after another by the instructor; the other group of questions was posted online after the class was dismissed. In the face-to-face setting, the discussion continued until exhausted, and then a new question was posed; in the online setting, four questions were posted by the instructor on the class WebCT Discussion Board and students were asked to post responses three to four times during the remainder of the week. The face-to-face discussion was held during class meeting times on Tuesday evenings, lasting one to two hours; the online discussion was held from Wednesday through the following Monday. Students' postings to the discussion board were not graded nor were points toward the final course grade given for their participation. The average number of postings across all discussions was 4.89 per student, well above the range requested by the instructor, and included all students in the class.

B. Data Collection

Data were gathered from these students at several times in the course. First, at the close of the face-to-face discussion, they were asked to complete a paper-and-pencil questionnaire containing six statements about a) the depth and comprehensiveness of the discussion, b) the length and use of resources in the discussion, c) the ability of the student to remember details and "who said what," and d) and a self-assessment of how the student learned "best" or "more." Answers were provided on a five-point Likert scale from very true = 1, moderately true = 2, somewhat true = 3, a little true = 4, not at all true = 5. The instrument was limited to six items because prior experience indicated that the discussions can be exhausting and having better answers to fewer questions was more important than asking lots of questions.

Second, at the close of the online discussion, an online survey was available on Monday and Tuesday and asked each student the same questions using the same Likert scales as had been asked after the face-to-face discussion (these data are displayed in Tables 1 through 5). Third, this online survey also asked them to compare the face-to-face and online discussion on the same measures (contained in Tables 6 through 10) and choose which discussion (face-to-face versus online) they preferred based on the statement. They also had an option of selecting "no difference." Fourth, Tables 11 through 16 reformat information in Tables 6 through 10 to better display comparisons across the discussions for each measure.

Lastly, to see if students' answers changed after the passage of time, a question on the course final exam asked the students to rank order the different discussion topics in terms of their value and to indicate for each topic whether they preferred the face-to-face or online discussion (Table 17), which eliminated the "no difference" option. The exam also asked two additional, open-ended questions: "Think about our classroom (face-to-face) and online discussions (in WebCT). Which mode (F2F or online) was deeper, better, more informative?" and "Which did you prefer, and why?" The analysis of the answers to the open-ended questions followed standard procedures for qualitative research [40] and identified themes, consistency in themes, and finally, exceptions to themes expressed by a minority of students.

C. Limitations

The different survey questions capture the points of view of the students surveyed, who were in most cases older adult students and professionals in their field serving as administrators or staff within higher education institutions. In one sense, their responses may not be generalizable to other students in different courses. In another sense, these students are often reliable witnesses to their own learning processes. They are sufficiently mature so that when the discussion could and did become strained as opinions were expressed in a passionate fashion, respect for the principle of free exchange of ideas was confirmed. But it is essential to remember that these responses are only for 13 graduate students. Conclusions and interpretations must be tentative and discussed with caution.

The study depends upon the students being able to remember the face-to-face discussion, which would have occurred days earlier, in order to compare it to the online discussion for which they would have an online transcript of the discussion. Therefore, comparisons may be justifiably suspect. However, this problem plagues all research that depends on student memories, and must be considered as no worse or different than other research that asks students for their opinions of classes that have occurred over time.

The students' responses to the questionnaires are reported by mean, frequency, or percentage and are therefore largely descriptive. Given that responses did not produce a mound distribution, t-tests were not advisable; given the low number of students, chi-square tests were not possible because too many cells were less than five. Therefore, it is important to interpret the results as suggestive until the study can be replicated and expanded.

IV. RESULTS

A. Mean Responses After Each Discussion

Tables 1 through 5 present the mean responses to the six Likert items after the students completed the face-to-face and online discussion. Occasionally, a student was unable to participate in a discussion, which is why sometimes the "n" is less than 13. This is not a problem for the assessment of the discussions in Tables 1 through 5, but will affect the ability of students to compare discussions in Tables 6 through 10.

Because there is no way to assess the significance of the difference in these means, it is perhaps best to assume that means that are close to each other (say within two or three tenths) are "nearly equal" and those that are greater are deemed "not equal." These designations are captured in the final column as "nearly equal" or "≈" and "not equal" as "≠." This solution to determining differences is imprecise, but it recognizes that usual tests of statistical significance are inappropriate in this situation. In any case, of the 30 comparisons across all five discussions, only five items can be deemed "nearly equal" given these criteria.

Table 1: Mean Response for Diversity Discussions

Very true = 1, Moderately true = 2, Somewhat true = 3, A little true = 4, Not at all true = 5

Item	After F2F Discussion (n=13)	After Online Discussion (n=13)	Difference
This discussion was in depth and comprehensive.	1.8	1.9	≈

I remember details on the ideas in our discussion.	1.6	3.5	≠
I thought we could have discussed much longer and used more resources.	1.9	2.0	≈
I learn more in this setting.	1.9	3.7	≠
I learn better in this setting.	1.5	3.6	≠
I remember who said what in our discussion.	2.1	2.6	≠

Table 2: Mean Response for Academic Freedom Discussions

Very true = 1, Moderately true = 2, Somewhat true = 3, A little true = 4, Not at all true = 5

Item	After F2F Discussion (n=12)	After Online Discussion (n=13)	Difference
This discussion was in depth and comprehensive.	1.5	1.8	≈
I remember details on the ideas in our discussion.	1.8	3.0	≠
I thought we could have discussed much longer and used more resources.	2.8	2.4	≠
I learn more in this setting.	1.9	3.1	≠
I learn better in this setting.	1.8	3.8	≠
I remember who said what in our discussion.	1.8	3.2	≠

Table 3: Mean Response for Political Tolerance Discussions

Very true = 1, Moderately true = 2, Somewhat true = 3, A little true = 4, Not at all true = 5

Item	After F2F Discussion (n=12)	After Online Discussion (n=13)	Difference
This discussion was in depth and comprehensive.	1.3	2.4	≠
I remember details on the ideas in our discussion.	1.6	3.2	≠
I thought we could have discussed much longer and used more resources.	3.3	2.5	≠
I learn more in this setting.	2.0	3.3	≠
I learn better in this setting.	1.6	3.8	≠
I remember who said what in our discussion.	2.0	3.0	≠

Table 4: Mean Response for Affirmative Action Discussions

Very true = 1, Moderately true = 2, Somewhat true = 3, A little true = 4, Not at all true = 5

Item	After F2F Discussion (n=12)	After Online Discussion (n=13)	Difference
This discussion was in depth and comprehensive.	2.1	3.0	≠
I remember details on the ideas in our discussion.	1.7	2.5	≠
I thought we could have discussed much longer and used more resources.	2.2	2.5	≈
I learn more in this setting.	2.1	3.5	≠
I learn better in this setting.	1.8	3.8	≠
I remember who said what in our discussion.	1.8	2.9	≠

Table 5: Mean Response for Gender Discussions

Very true = 1, Moderately true = 2, Somewhat true = 3, A little true = 4, Not at all true = 5

Item	After F2F Discussion (n=10)	After Online Discussion (n=12)	Difference
This discussion was in depth and comprehensive.	1.4	2.3	≠
I remember details on the ideas in our discussion.	1.7	2.4	≠
I thought we could have discussed much longer and used more resources.	3.0	2.8	≈
I learn more in this setting.	1.9	3.0	≠
I learn better in this setting.	1.9	3.5	≠
I remember who said what in our discussion.	1.7	2.6	≠

B. Preference for Discussion Setting by Likert Item

Tables 6 through 10 capture the students' comparisons of the two discussions, one held face-to-face and the other online. They were asked to choose which discussion they preferred or indicate "no difference," so the numbers in these tables represent a simple frequency of "votes" for that setting. Tables 1 through 5 present a picture of clear advantage for the face-to-face setting, which received the majority of votes in each discussion, ranging from 33% to 54% for a total average of all votes cast of 43%. The online discussions received a minority of votes as the preferred setting for the discussions, receiving a total average of all votes cast of 20%. But what is perhaps most intriguing are the votes of "no difference," which increase across the discussions, from 24 in the first discussion, 29 in the second, 25 in the third, 33 in the fourth, 27 in the fifth for a total of all votes cast of over a third (35%) of the students in the class.

Table 6: Comparison of Diversity Discussions (n=13)

Item	F2F	Online	No Difference
This discussion was in depth and comprehensive.	4	8	1
I remember details on the ideas in our discussion.	7	4	2
I thought we could have discussed much longer and used more resources.	5	1	7
I learn more in this setting.	7	2	4
I learn better in this setting.	8	2	3
I remember who said what in our discussion.	6	0	7
Total votes	30	17	24
Percent of total votes cast	42%	24%	34%

Table 7: Comparison of Academic Freedom Discussions (n=12)

Item	F2F	Online	No Difference
This discussion was in depth and comprehensive.	6	4	2
I remember details on the ideas in our discussion.	5	2	5
I thought we could have discussed much longer and used more resources.	3	3	6
I learn more in this setting.	8	1	3
I learn better in this setting.	7	3	2
I remember who said what in our discussion.	3	0	9
Total votes	32	13	27
Percent of total votes cast	44%	18%	38%

Table 8: Comparison of Political Tolerance Discussions (n=12)

Item	F2F	Online	No Difference
This discussion was in depth and comprehensive.	7	3	2
I remember details on the ideas in our discussion.	6	2	4
I thought we could have discussed much longer and used more resources.	3	1	8
I learn more in this setting.	9	2	1
I learn better in this setting.	10	0	2

I remember who said what in our discussion.	4	0	8
Total votes	39	8	25
Percent of total votes cast	54%	11%	35%

Table 9: Comparison of Affirmative Action Discussions (n=12)

Item	F2F	Online	No Difference
This discussion was in depth and comprehensive.	5	5	2
I remember details on the ideas in our discussion.	5	2	5
I thought we could have discussed much longer and used more resources.	2	2	8
I learn more in this setting.	7	2	3
I learn better in this setting.	8	1	3
I remember who said what in our discussion.	4	0	8
Total votes	31	12	29
Percent of total votes cast	43%	17%	40%

Table 10: Comparison of Gender Discussions (n=12)

Item	F2F	Online	No Difference
This discussion was in depth and comprehensive.	2	4	6
I remember details on the ideas in our discussion.	3	5	4
I thought we could have discussed much longer and used more resources.	2	3	7
I learn more in this setting.	8	2	2
I learn better in this setting.	7	3	2
I remember who said what in our discussion.	2	2	8
Total votes	24	19	29
Percent of total votes cast	33%	26%	40%

C. Preference for Setting across Discussions

Tables 11 through 16 reformat the information in Tables 6 through 10 to place the emphasis on the measure or Likert item across the five discussions. These displays make certain relationships clearer. First, the students gave an equal number of "votes" to each setting, implying that they felt the depth of the discussions were equivalent (Table 11). Second, there is a slight advantage to face-to-face discussions for remembering details and a much larger advantage for face-to-face discussions for remembering "who said

what" (Tables 12 and 16). Third, it is clear that these students felt they learned more and better in face-to-face discussions (Tables 14 and 15). Lastly, this formatting makes it clear that the largest percent of votes are for "no difference" on two measures: "could have discussed longer and used more resources" as well as remembering "who said what" (Tables 13 and 16). This last difference may be due to the fact that the online discussion occurred over one week and the face-to-face discussion for one to two hours, but since discussions in these settings are invariably of different lengths, the shortness of the face-to-face discussion may be a limit and the unlimited nature of online discussions an advantage.

Table 11: Student Preference for Setting Based on Depth of Discussion

Discussions	F2F	Online	No Difference
Diversity	4	8	1
Academic Freedom	6	4	2
Political Tolerance	7	3	2
Affirmative Action	5	5	2
Gender	2	4	6
Total votes	24	24	13
Percent of total votes cast	39%	39%	21%

Table 12: Student Preference for Setting Based on Remembering Details

Discussions	F2F	Online	No Difference
Diversity	7	4	2
Academic Freedom	5	2	5
Political Tolerance	6	2	4
Affirmative Action	5	2	5
Gender	3	5	4
Total votes	26	15	20
Percent of total votes cast	43%	25%	33%

Table 13 :Student Preference for Setting Based on Could Have Discussed Longer and Use More Resources

Discussions	F2F	Online	No Difference
Diversity	5	1	7
Academic Freedom	3	3	6
Political Tolerance	3	1	8
Affirmative Action	2	2	8
Gender	2	3	7
Total votes	15	10	36
Percent of total votes cast	25%	16%	59%

Table 14: Student Preference for Setting Based on Learn More in Setting

Discussions	F2F	Online	No Difference
Diversity	7	2	4
Academic Freedom	8	1	3

Political Tolerance	9	2	1
Affirmative Action	7	2	3
Gender	8	2	2
Total votes	39	9	13
Percent of total votes cast	64%	15%	21%

Table 15: Student Preference for Setting Based on Learn Better in Setting

Discussions	F2F	Online	No Difference
Diversity	8	2	3
Academic Freedom	7	3	2
Political Tolerance	10	0	2
Affirmative Action	8	1	3
Gender	7	3	2
Total votes	40	9	12
Percent of total votes cast	66%	15%	20%

Table 16: Student Preference for Setting Based on Remembering Who Said What

Discussions	F2F	Online	No Difference
Diversity	6	0	7
Academic Freedom	3	0	9
Political Tolerance	4	0	8
Affirmative Action	4	0	8
Gender	2	2	8
Total votes	19	2	40
Percent of total votes cast	31%	3%	66%

D. Rank Order of Discussions

Approximately 3 weeks after the last discussion, a take-home final exam was given. As part of the exam, students were asked to reflect on the two types of discussions across the five topics and rank order their preference for the topics and then choose which mode or setting worked best for them. Table 17 presents the mean rank and their choices for best setting. The online discussions were deemed "best" by more students than one might expect by viewing Tables 6 through 14. This may be due to forcing students to choose a "best" setting (they weren't given the option of choosing "no difference" in this request), but it may also capture a real difference. Perhaps students had a better experience with the online discussion than originally thought.

Table 17: Rank Order of Discussions and "Best" Setting at Final Exam

Topic	Mean Rank	F2F Best	Online Best
Diversity	1.75	5	7
Academic Freedom	3.17	8	3
Political Tolerance	2.92	8	4

Affirmative Action	3.08	6	6
Gender	3.42	9	3
Total votes		36	23
Percent of total votes cast		61%	39%

E. Responses to Open-Ended Question, "Why?"

At the end of the final exam, students were asked two open-ended questions asking them to (1) discuss which mode (face-to-face or online) of discussion was deeper, better, and more informative, and (2) then discuss which mode they personally preferred. The answers reflect three themes: (1) advantages of face-to-face discussion, (2) advantages of online discussion, (3) and the complementarity of the two settings.

The advantages of face-to-face discussion can be captured by three sub-themes. The first sub-theme, and the one mentioned most frequently by students, was the *emotion, energy, fluidity, and ease* of face-to-face exchanges. These descriptors capture very real advantages that most people enjoy about face-to-face exchanges. Another sub-theme that captures reasons for giving the advantage to face-to-face discussions was the ability to read *nonverbal signs* (body language, facial expressions), which seemed very important to some students. While the last sub-theme had only two mentions, it is perhaps the most insightful: with *immediate feedback* (through nonverbal cues or verbal responses from their classmates), the students' points-of-view are immediately evaluated and in a way that is "often more memorable," said one student. Another student put the issue in this way, "It is easier to respond and react in the face-to-face discussion. You can more easily defend your responses and change your perspective too." This may support the advantage of face-to-face exchanges for assessing the success of your argument with your classmates—their frowns are ample feedback—as well as their advantage for remembering details in a discussion and "who said what" as captured in Tables 12 and 16. This comment also raises a question that cannot be resolved by the current study, whether changing one's point of view occurs in the face-to-face setting because confrontation (or questioning another's reasoning) is more effective in the face-to-face setting; this also makes one wonder if the lack of face-to-face confrontation in strictly online learning might lead to the fewer changes in the point-of-view of students.

The advantages of online discussion can be captured by three sub-themes. The first sub-theme is well-established in the research literature on online discussions: the ability to take the *time and care to reflect* on what response should be made, or as one student put it, "I can express myself better when I can think about what I want to say." And another wrote, "Working from home and having more time to think and reflect before responding yielded deeper and better thought-out postings." The second sub-theme refers to the online discussions being *more reasoned, providing more information, and perhaps deeper analysis*. "Oral responses are sometimes instinctive rather than reasoned," noted one student. Or as another student who expressed a preference for the face-to-face setting indicated, "I like to … hear passion … I want to voice [my] opinion. If I have to type my response, I tend to be less vocal, opinionated, passionate." Another student wrote, "I preferred online . . . because I had to really think and write my comments in a way as not to offend … when you are talking about issues, it is so easy to get caught up in your passions that you may come across as offensive, narrow-minded, or prejudiced." These latter two comments indicate that the two settings may be complementary: face-to-face stirs and is more suitable for the expression of passion, but the online environment tends to temper the passions, cools them perhaps, or forces them into the linear, rational world of written prose. The last sub-theme, noted by several students, was the opportunity for the *quieter students to open up online*.

Lastly, one student identified the *importance of "blending" both types of discussions*: "Both environments have limit[s]… so one is not necessarily better than the other, but different." If the two settings are complementary—as the comments about expressing passion versus expressing thoughts in a more rational manner above imply—then the issue is how faculty can use this finding in ways to enhance learning for all in a blended learning approach. If the two modes of discussion—face-to-face and online—are different, how can instructors ensure that discussions in the different settings complement each other and maximize learning for students with different strengths and weaknesses and different preferences for the energy of face-to-face meetings or for the time to reflect in the online setting? This means that the issue may not be which setting has an advantage—both do—but how to thoughtfully design instruction so as to capitalize on the complementary aspects of the settings in ways that draw on the strengths of all students and help all students address their weaknesses.

V. DISCUSSION

This research cannot be definitive, but it is suggestive of a number of interesting insights into how these students perceived face-to-face and online discussions in a blended learning context. First, when it comes to the depth and comprehensiveness of a discussion, the face-to-face and online settings were rather equivalent. Although one might expect that depth and comprehensiveness might be an obvious advantage of the online setting, it did not hold true in the eyes of these students.

Second, another advantage for the online setting in the literature is its ability to expand the time and resources available for an educational objective [26]. However in this study, the majority of students indicated no difference between the settings on this measure, so perhaps this is a "draw" when comparing the two settings.

Third, remembering details and "who said what" seem to be better in the face-to-face setting for these students. This is intriguing, since the script of the online discussions would have been available to them to help remember and they might have just completed reading the last postings to the discussion prior to taking the survey. So perhaps this question does capture an important difference: face-to-face discussions allow students to capture the feel, tone, and emotion of an exchange that helps memories to form and be remembered.

Fourth, when asked to distinguish between the settings in their ability to support learning—either learning more or better—a clear majority of students prefer the face-to-face discussions as was found by others [25, 26, 27]. A minority prefer the online discussion and another minority express no preference. And as an aside to future researchers, these students did not rate "learn more" much differently than "learn better." The differences in scores for each discussion ranged from no difference to seven-tenths of a difference. Perhaps in the future, one or the other term would serve the researcher as well as trying to determine differences that students have difficulty distinguishing.

Fifth, what may be most intriguing in these comparisons is the large number of times the students chose "no difference" between the settings. Perhaps this is a sign that at least one-third of students find the two settings equitable. This may bode well for some day putting to rest the need to compare the settings in order to justify using online discussions in instruction.

Sixth, although the students seem to have firm preferences for one setting, the reasons for their preference are in some ways complementary: passion versus reason, energy versus time, instinctual versus reflection. Another way this may be characterized is that both settings present communication barriers for different

students; therefore, blended learning levels the playing field and encourages even participation [41]. These insights into the complementarity of the two discussion settings argue for a better understanding into how each setting could complement the other in a course, allowing some students to enjoy the energy and flow of face-to-face discussions but others to shine in their well-thought-out online postings.

Seventh, the issue in front of instructors is how to translate student preferences into a well-designed instructional experience. How should the complementarity of the two settings be incorporated into a blended learning course? These findings encourage instructors to use both types of discussions, perhaps stressing questions that encourage energetic exploration in the face-to-face setting, but developing questions or issues that require thoughtful and rational resolutions in the online setting. Brainstorming ideas may work better in the face-to-face setting, but analyzing and evaluating those ideas will be better in the online setting. And while challenging student thinking must occur whenever it is appropriate, perhaps it is more effective in the face-to-face setting. The instructor would be wise to take into consideration the characteristics of each discussion setting when deciding upon the nature of the learning task or the charge to the discussants.

Lastly, the need for more and better research into understanding the specific advantages and disadvantages of the two components of blended learning is obvious. This particular research study cannot resolve the question of when to use face-to-face discussion or what topic may work best in the online setting or whether there are any differences at all. But it captures, in a small group of graduate students, how discussions may need to be done in both settings so that students can enjoy the advantages of the particular setting. One final insight worth further explication is whether what these students saw as "equivalent" or "not different" is accurate, or whether the settings are complementary in ways that researchers must investigate and instructors need to explore.

In a final analysis, students seem to feel that in a comparison of face-to-face and online discussions, the advantage goes to . . . both. There are positive characteristics of each setting for a discussion and negative ones as well. But what may be most intriguing is how the differences in the two settings may be useful for encouraging different types of learning experiences that are valuable . . . both of them.

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VII. ABOUT THE AUTHOR

Dr. Meyer is currently associate professor of higher and adult education at The University of Memphis specializing in online learning and higher education. She is the author of *Cost-efficiencies of Online Learning*, a 2006 publication of the ASHE-ERIC Higher Education Report Series. For over three years, she was Director of Distance Learning and Technology for the University and Community College System of Nevada. Prior to this, she served over 8 years as Associate Director of Academic Affairs for the Higher Education Coordinating Board in the state of Washington and was responsible for technology planning and policy related to online learning.

WHAT IT TAKES TO INNOVATE: THE EXPERIENCE OF PRODUCING AN ONLINE, REAL-TIME CASE STUDY

Dr. James Theroux
Flavin Professor of Entrepreneurship
Isenberg School of Management
University of Massachusetts

ABSTRACT
The case method can be classified as a type of experiential learning because students treat the problem in the case *as if* it were real and immediate. Until the Internet there was no practical way for cases to actually *be* real and immediate. The Internet makes possible instantaneous distribution of cases, and it makes possible their creation in real time. This article describes a recent attempt to use the Internet to bring business reality to business courses, and to facilitate communication among instructors, students, and the case company. It explores the challenges and difficulties involved in producing a new type of case study, and it assesses the feasibility of doing so on a regular basis. The goal of the author is to stimulate a dialog about how the Internet can be used to move forward all of our teaching methods, but especially the one that is prominent in schools of business: the case method.

KEYWORDS
Real-time Case (RTC), Innovation, Engagement

I. INTRODUCTION

The case method can be classified as a type of experiential learning because students treat the problem in the case as if it were real and immediate. Until the Internet there was no practical way for cases to actually be real and immediate. The Internet makes possible instantaneous distribution of cases, and makes possible their creation in real time. This article describes a recent attempt to use the Internet to bring business reality to business courses, and to facilitate communication among instructors, students, and the case company. It explores the challenges and difficulties involved in producing a new type of case study, and it assesses the feasibility of doing so on a regular basis. The goal of the author is to stimulate a dialog about how the Internet can be used to move forward all of our teaching methods, but especially the one that is prominent in schools of business: the case method.

With the support of the Sloan Foundation, the Kauffman Foundation and the Coleman Foundation, 2001 saw the launch of an innovation in the case method called the real-time case (RTC). A description of what a real-time case looks like and how it works are available at http://intra.som.umass.edu/theroux. An evaluation was conducted on how RTC was received by participating students [1] and by faculty [2].

In brief, a real-time case is a series of weekly case studies all focusing on a single company. The case installments are written as the events being described are unfolding, in real time. Each weekly case focuses on a problem facing a company at that moment, and invites students to solve it. By the end of a

semester students will have studied the subject company in depth, and will have had some direct contact with the company via the Web. Here is an excerpt from the syllabus of a course centered on a real-time case:

> *As you read this, the managers of a new high-tech company are striving to achieve the entrepreneurial dream. On a password-protected website (realtimecasestudy.com) you will follow that company, and see their progress week by week. You will be actively engaged with the company, analyzing its problems, and making input. You will be participating, along with 245 other students, in a full-semester, real-time case study.*
>
> *Unlike traditional case studies, this real-time case will dig deeply into one company during the entire semester. As this moment a case writer is stationed full-time at the case company. Each week the writer will provide us with the information we need to analyze a particular problem or question faced by the company. But our goal is not analysis for its own sake. Instead, we want to go beyond critiquing and make valuable recommendations to the company. The company is counting on us to perform, and we want to deliver.*

Results from the 2001 case were positive: students and faculty became supporters of the real-time case, and the concept garnered three national awards for pedagogical innovation [3]. Accordingly, the project director and his funders were motivated to produce a new real-time case in the fall of 2004. The purpose of the second case was to validate results from the first, to expand the use of the case from four universities to eleven, and to try to make improvements in case production.

The subject company for the 2004 case, Company B, was in the business of creating software tools that are used by chip designers. As such, it is part of the highest of high-tech industries. Its employees work in a world that is invisible to the eye but filled with possibilities and complexities. They are on the forefront of new products and technology.

During the first implementation of RTC in 2001 109 students at four universities participated in courses in which the real-time case was the main feature. The 2004 program, in which 245 students at 11 universities participated, utilized the same RTC format as the 2001 pilot, but covered a different company as its subject. During both iterations of RTC, students experienced a full-semester immersion in the life of a single company, mediated by the Web. On the Web students read about the company, they saw and talked to the company managers (via video clips and video conferences), they engaged in online chat with company personnel, and they gave feedback to the company about the problems detailed in weekly case installments.

The pedagogical objectives of the case were, first, to bring students to a new level of energy, engagement, and participation. And second, to teach students some lessons that are hard to teach using conventional methods. In particular, the new type of case study, dubbed the “real-time case” (RTC) aimed to 1) instill in students a greater appreciation of the complexity of business decision making; 2) portray a more realistic view of business; 3) take a more interdisciplinary view of problem-solving; and 4) teach all these lessons in a way that is more memorable than the traditional case method.

II. SCOPE OF THE ARTICLE

To make an impact on online education and on management education, any pedagogical innovation must pass three tests: 1) students must like it, 2) faculty must find it worth the switching cost; and 3) the innovation must be economical and practical to produce. As cited above, RTC has been well received by

students and faculty. What remains is to analyze the feasibility of producing a real-time case. That is the subject of this article.

It is one thing to say that the power of the Internet must be brought to bear on one of the mainstays of business education, the case method. But it is another matter to do it. The main purpose of this article is to explore the feasibility of implementing the real-time approach worldwide by describing in detail what it takes to actually produce the material that is consumed by students and faculty. A warning to the reader: It is the judgment of the case production team that *the RTC method as developed by the author is not one that is economical to produce on a regular basis by every university. It is however realistic for one or more schools per country to produce a case in a given year and to share it via the web with any number of teaching institutions.* Nevertheless, there no doubt are alternative models for producing a real-time case that might yield much of the benefit with a fraction of the cost and effort. We do not speculate on that here, but leave it to the reader to come up with new approaches.

Regarding the production of a real-time case, we investigated questions such as 1) how to select the case company and the case writer, 2) how to choose case topics that bring theory to bear on the real world of company-building, 3) how to manage the relationship with the case company, 4) what methods can be used to engage students and connect them to the case company 5) what kind and amount of work is required of professors utilizing RTC, 6) what skills and attitudes professors must possess to be successful in teaching a real-time case, 7) what course management platform and communication technologies make sense, and 8) what are the costs of producing a real-time case.

III. INTRODUCTION TO THE 2004 CASE PRODUCTION

During the 2004 fall semester a consortium of 11 business schools implemented RTC (see Appendix A for list of participating schools).

The professors at the consortium schools all teach courses in entrepreneurship, so entrepreneurship was the subject taught using the real-time case. The area of entrepreneurship dovetails well with RTC because it takes a general management perspective—allowing analysis of problems from any or all of the business disciplines.

The academic director's role was to guide the case writer in the selection and development of topics to be covered in the weekly installments of RTC. Because the academic director is an experienced teacher, he was able to recognize case topics that are appropriate for entrepreneurship courses.

The weekly case installments were documents, sometimes supplemented with video, that are similar in format and writing style to conventional case studies that any major case-writing school might produce. The weekly case was coupled with one or two commercially available "technical notes" (conceptual/theoretical articles) that shed light on the problem addressed in that week's case. The weekly case and the technical note formed the backbone of RTC.

IV. PRE-CASE ACTIVITIES

Before the discussion about producing case material, a few words should be said about steps that had to be taken in advance: raising funds, selecting the case company, and hiring the case writer.

A. Raising Funds

Funds for the 2004 implementation of RTC were received from the Coleman Foundation, the Kauffman Foundation, student payments, and the university that produced the case (name withheld during review) The funds were used to hire a seasoned business journalist to serve as the case writer, to purchase video equipment, to purchase web design and hosting services, and to provide general support. Details on the economics of case production are found below in the section so named.

Assuming a September launch for the case, recruiting for the case company and the case writer had to commence by January of that year. Accordingly, funds had to be *in hand* by then January so that discussions with companies and writers were not purely speculative. In order for funds to be in hand by January, fundraising began in the middle of the year prior to launch (15 months before students read the first case installment).

B. Selecting the Case Company

In January 2004 we were looking for a case company that met several criteria. We wanted a company whose industry would appeal to students, and whose product would be fairly easy to comprehend. We preferred a company that was relatively new and venture-capital-financed. Companies like this have so much going on that we felt confident of finding plenty of meaty decisions that would have to be made during our time studying the company.

Because the company would be exposing itself to the class, and perhaps the public, there had to be chemistry and trust between the case company CEO and the academic director, and a strong commitment to staying the course in spite of whatever difficulties might arise. Trust is a key to openness, but even if there is trust, individuals vary greatly in how careful and open they are with information. We were seeking a CEO situated on the open side of the continuum. In general, a CEO whose main experience has been in big corporations would not fit this description. And a company with a staff attorney would also tend to present problems in getting approval for case publication. Finally, because the academic director expected that he would be visiting the company at least once a week, the company needed to be located within two-hour driving distance from the academic director's office.

The academic director found three companies that on a preliminary basis seemed interested and willing to participate. He interviewed four others that declined to participate, primarily for fear of time commitment or confidentiality. Of the "willing three," one was in a high-tech industry. Because a couple of the participating universities included engineers in their classes, and because of the "sexiness" of high tech, we focused our negotiations with COMPANY B.

By selecting COMPANY B as our case company we somewhat inadvertently launched ourselves into a second experiment in pedagogy (the first being the RTC concept itself). That experiment was to see how feasible it would be to teach a case study about a company whose product would be incomprehensible to the layperson. We were intrigued by the challenge of delving into the high tech world. It turns out that some of the students were intrigued as well, while others were less willing to do this. Getting a handle on a new tech lingo took weeks of study before we could begin discussing the business issues of the case company. Some students never got the hang of it. Others loved it.

COMPANY B had received its first venture capital investment in October 2003 just a few months before the Real-Time Case Project had received its funding. As a result, the timing was perfect: the company's funding would last at least until the end of the semester, an important qualifying criterion. COMPANY

B's CEO and founder, was introduced to the academic director.

It is not clear what motivated the CEO to want to participate with us, but it seems that his interest in education and giving back to society were key factors. He had been a professor of engineering for most of his career, and had not previously worked in private industry, nor had he been a CEO.

COMPANY B did not make its commitment quickly. It took several meetings between the company and the academic director to discuss the project and to brainstorm about the risks and opportunities. Of course the company was worried about things such as embarrassment to individuals, and leaking of company secrets. We assured the company that they would have an opportunity to review material we wrote prior to web posting. And we felt that we could find diplomatic ways of saying things that would protect the dignity of the individual without distorting the business issues at hand. In addition, we developed written "rules of engagement" which guided our relationship (available upon request). And we explained that each student would sign a confidentiality agreement (available upon request).

Before finalizing the engagement, the academic director asked to meet with the staff of fifteen then working at COMPANY B. The CEO dragged his feet about this, and in the end did not want to set up the meeting. He felt it was not necessary. The academic director disagreed, but did not let this stop the process. This should have been a warning sign about the difficulty that we would have in getting the case company's active participation. Another important step before concluding an agreement was approval by the company's board of directors, which was composed of its investors. The CEO assured me that he would do this. It is not clear exactly what he said to the board, but we assume it was adequate. The CEO was quite protective when it came to our case writer contacting the board, but by the end of the semester he allowed a couple phone interviews.

There was no single written document that represented the company's commitment to the project. Instead there was a series of emails from the CEO, plus the written rules of engagement. In future productions of real-time cases, it would probably be a good idea to have some sort of contract. In the present case, the trust and good will between the CEO and the academic director were considered sufficient. This was put to the test in the middle of the semester when the CEO told the academic director that the quid pro quo for his involvement in the case was for the academic director to write a business plan. There were no emails to this effect, and the misunderstanding strained the relationship between the CEO and the case team.

The COMPANY B CEO seemed committed at the outset to making the real-time case a success. However, his willingness to interact with the case team and students turned out to be about half of what the previous case company delivered.

C. Selecting the Case Writer

When thinking about the qualifications for a real-time case writer, three main factors came to mind. First, RTC requires a fast, efficient writer who can meet the weekly deadline. One finds that skill most commonly in a professional writer such as a print journalist. The second quality one would like to see is a strong academic knowledge of business. Such knowledge is necessary to be able to separate simple human interest from academically meaningful content. Essentially, the ideal case writer should have the "textbook of business" in his head, allowing him to see how the facts he observes can be organized in a coherent way. Knowing what issues are amenable to analysis using academic theory should guide the writer in asking questions. Such an approach is helpful in creating a case-based course, as opposed to a non-fiction drama such as "The Soul of a New Machine" by Tracey Kidder. A third qualification would

be the ability to wear well at the case company, sustaining cooperation and access. That ability could be based on several skills and traits. Perhaps an agreeable personality would be sufficient. But more likely business experience, in particular experience as a consultant, when combined with an agreeable personality would make the case writer a welcome presence at the case company's offices. A person who is a respected business specialist would be viewed as a valuable member of the team. How the case writer would share his or her opinions is a delicate matter, but is something that can be managed.

As one can see from the above qualifications, a great case writer is a rare person. How many people can be a business expert, prolific writer, and diplomat—all wrapped into one? On top of all this, the case writer must give over his life to the project for five months: entrepreneurial ventures operate seven days a week, and many hours a day. The case writer has to go where the action is, and that may not leave much room for a personal life during the assignment. On the positive side, most writers and business professionals view the assignment as being a plum because it allows access to the subject that is much deeper than a drop-in interview.

In order to attract a freelance writer with top qualifications it is necessary to pay around $10,000 per month in a major urban market. Attracting a high-powered business consultant (who also happens to be an excellent writer) can cost upwards of $30,000 per month. Our project did not have the budget to hire a business consultant, so we settled for a freelance writer. And it turned out that $10,000 per month was below what the writer was accustomed to earning. He only agreed to take a pay cut because of his interest in the nature of the work, and his relationship with his former boss who was a strong advocate of the RTC concept.

Perhaps an alternative to the high cost of case writers would be to find a professor who could make the case writing project the subject of his sabbatical. Very few professors have the facility with writing to meet the weekly deadlines, and many lack the personality to be a resident observer. However, there may be some who do fit the description, and it would not be too hard to find them so long as it can be done a year or more in advance.

To be able to commence case writing in September, the case writer had to begin work no later than Aug. 1 in order to do background research about the case company and its industry.

The case writing assignment was full-time from August through December. For a high-powered professional to take five months away from whatever they do normally, he or she must do quite a bit of rearranging in his professional life. Even freelancers have projects lined up months in advance. For most prospective recruits, an Aug. 1 start date meant that recruiting conversations had to begin in February, and be concluded around April. Complicating matters, the geographic location of the case company influenced the selection of the case writer, unless the RTC director could have found a case writer who was willing to pick up and move to wherever the case company might be located. Accordingly, the case company recruiting had to go hand in hand with the case writer recruiting.

The 2004 Real-Time Case Project followed the above pattern. Fortunately, the former editor-in-chief of Inc Magazine had agreed to use his extensive network of contacts with writers to find an ideal candidate for us.

V. PRODUCING A REAL-TIME CASE STUDY

A. Choosing Case Topics

As soon as the case company was selected, the academic director began thinking about possible case topics. That required the academic director to think like a business consultant, whose first step would be to learn about COMPANY B's business. Always respecting the amount of time that the CEO could spare, the academic director sought on his own as much information as was available in the public domain about the company and its industry (chip design). Developing a thorough knowledge of the relevant technology, customers, suppliers and competitors was a necessary prelude to sitting down with the CEO to hear what he considered to be his most perplexing problems or decisions. These problems or decisions formed the basis for case topics. In general, selecting problems identified as priorities to the CEO will be all that it takes to maintain the CEO's attention. But in this case it turned out the CEO held a low opinion of what outsiders could tell him.

Because of the radical nature of the case company's technology, we felt it necessary to devote three weeks to learning the lingo of chip design. Only thereafter could we begin to understand the company's products, markets, and competitors.

After the tech intro, the first case gave enough information about the case company and its industry so that students could form judgments about the company's prospects. The company, believe it or not, did not have a formal business plan, even though a venture capital firm had given them $6 million. So the case writer pieced together something that looked like the beginning of a plan. Any basic entrepreneurship course deals with the issue of what makes a good business plan. Students were simultaneously introduced to the case COMPANY B by reading its plan, and went through an exercise of critiquing the plan. In the COMPANY B case the COMPANY B business plan we created was enough for students to begin understanding the company's business model.

After the tech intro and the business plan, the academic director, in conjunction with the case writer, had to select case questions/topics where the objective was to solve a problem for the company. As with most startups there were promising case topics in each of the following areas: 1) marketing dilemmas—either figuring out its target market, finding out how best to sell to it, deciding how to price its product; 2) financing dilemmas—every new company worries about where its next round of financing will come from, even if there's money in the bank for the coming year; and 3) every new company is building its staff and has human resource issues about whether the people and the structure are right for the task. COMPANY B was no different.

Some of these case topics were "one and done," meaning that they were not ongoing issues at the company, but matters that could be resolved once and for all. COMPANY B for example, had to make a one-time decision about selecting is headquarters location. Others such as product definition and market segmentation became major themes that were revisited later in the semester, either in the form of "news updates" or in the form of "follow-up cases."

No matter what topic was chosen, a certain amount of planning had to be done to make the production process manageable. It was helpful to know what topic would be covered three weeks hence; that allowed the case writer to be more efficient when doing interviews and data collection. It also reduced the likelihood that a week would arrive without a case ready to be posted. That may sound hard to imagine, but unless there is a good "Plan A" *and* a good "Plan B", there may be a disaster in case production. It is a good idea to have at least one case always on hand that can be posted in the event of an information-

gathering failure for the intended case of that week. There were three weeks during the semester (not sequential) when the case writer could not complete a case, but the academic director was able to bail him out by producing a case himself that he had been thinking of.

Planning ahead helped organize the case writing process, and it also gave students some peace of mind. A course based on a real-time case is different from every other course in the following sense: Normally when students arrive at the beginning of the semester they find a syllabus that lays out before them everything that they will be obliged to do. The real-time case asked them to trust the professor that what would appear would be reasonable and interesting. When students began the semester, the first few topics of the real-time case were laid out, even though the content for them was not completed.

Before proceeding to a description of case production, we should mention two more issues related to choosing a case topic. The first has to do with what I call the level of focus. In conventional case courses, most cases aim at what I would call a high level focus, namely big strategic decisions that a company makes only rarely. For example, "What should be our competitive positioning?" or "Should we outsource production?" or "What distribution channels should we use?" The real-time case dealt with these big-picture, high-level questions. Given the amount of time that students would be spending with the company, (a whole semester rather than a single class period), we hoped to produce a case that drilled down to the smaller decisions that companies make, and to look more at implementation issues than strategic decisions.

For some reason, both the 2001 case and the 2004 case stayed at the high level common to case courses. I am not sure why this is. Perhaps there is more comfort for both students and professors staying at that level. Perhaps the tools for analysis are more available at that level. Perhaps the company was pushing us that way. Since a course in entrepreneurship takes an interdisciplinary and comprehensive view of a company, perhaps a semester is barely enough to deal with all the big picture issues, and not enough time to go to the next level. Whatever the reason, I feel that there exists some undiscovered potential in the case process to delve into the many smaller decisions that make up daily life at a company.

A final issue related to choosing case topics dealt with the tension between two ways of presenting a company: a chronological narrative of what happens versus a relatively random attack on problems to be solved. Telling a company's story as a chronological narrative is probably a good way to draw students in and get them engaged with the company. However, it runs the risk of turning the classroom into a chat session, rather than a chance to practice analytical skills and problem-solving. Compared to the 2001 case, the case of 2004 did a better job at the chronological story. It did so by establishing a "blog" on the case website that almost every day included tidbits about the company's activities.

Once the academic director picked a topic for the weekly case, he began searching for published articles or book chapters that would guide students' analysis of the case material. In our first production of the real-time case, we were fortunate to negotiate a license with Harvard Business School Publishing to access articles in their vast collection. The cost was $20 per student. In 2004 we paid on a per-article basis, but the rate was discounted. Most weeks we made two such articles available to students. This provided an alternative to a textbook, and gave students plenty of theory with which to work.

B. Meeting the Weekly Deadline

Saturday 6:00pm. Come hell or high water we had to post a case and a related technical note (conceptual article) every week at 6:00pm Saturday. Many students asked if we could deliver the weekly material

sooner; most weeks it was available by Friday night, but Saturday at 6:00pm was the line we could not cross.

1. Gathering Data on Which the Case is Based

There were four primary sources of data: 1) internal company documents; 2) published information; 3) notes from meetings at which the case writer was an observer; 4) notes from interviews conducted by the case writer; and 5) opinions from outside experts. Each presented its challenges.

The dream for the case writer and the academic director was to find a document that could be a case unto itself. The most obvious example is the company's business plan. Unfortunately, this did not exist at COMPANY B. Also, most company documents were so highly technical that they could not be read by laymen, so we had to "translate" many of them. We did have one low-tech case: the company needed to find larger quarters, and the process of that search included many documents that any business student could grasp.

When we actually began the case writing process it turned out to be harder than we thought to get access to documents. The case writer had a hard time getting the attention of the CEO to establish procedures for collecting documents and attending meetings. In the end though, we were able to get enough data to produce meaningful cases.

Of course it was much easier to gather published information. The typical info we searched for was about customers, competitors and suppliers. The Web worked well for this, though we almost always needed to supplement Web info with phone interviews. The press of on-site information gathering made it difficult for the case writer to do much external research. Accordingly, external research was handled by research assistants at the academic director's university.

A third source of data was notes from meetings at which the case writer was an observer. The case writer did a pretty good job of attending scheduled company meetings at which several managers were present, but he was not terribly successful at getting into the flow of ad hoc meetings between just a couple of people. Also, we were able to attend only a few meetings with outsiders such as customers, financiers, and suppliers. These were extremely valuable. Part of the problem was our inability to be in two places at one time. For this reason, we recommend that the case writing task be handled by two people in future case productions. There was also a selling job (to get access) that needed to be done with company management, and it was harder than we expected in the 2004 case.

The problem with collecting data as an observer at meetings is that it was much less efficient than conducting interviews. On the other hand, attending meetings was a great way to keep up with the action and to encounter that serendipitous comment which led to a future case topic. Furthermore, the company had only a limited tolerance for spending time one-on-one with the case writer. This again argues in favor of having two case writers, one mainly to attend meetings, and the other to do interviews. To insure proper coordination, the writer attending meetings would have to write up notes daily, and share them with the head case writer and the academic director.

Collecting data via face-to-face interviews with company managers was ideal for the case writer, but less than ideal for the subjects. The pressure to build the company was palpable, and time was of the essence for company managers. Because it was so hard to nab the managers at the office, and because the case writer was reluctant to stay late (when it was easier to get their attention), he resorted to scheduling the

interviews via telephone, and was sometimes best able to reach the subject via cell phone when he or she was in the car commuting.

We were fortunate to have two or three industry experts who were intimately involved with the case, one at the academic director's university, and the other at Olin College of Engineering. Their technical expertise helped us to evaluate and interpret what we heard at the company.

Before we move on to the process of writing, review, and editing, a word should be said about gathering video data. Our view from the outset was that video could play a valuable role in situations where a picture could say something hard to convey in words. For example, we felt that the personality of the managers could be more accurately divined with video. And the technology employed by the company is much easier to understand with visuals. Unfortunately, we had a hard time getting case company personnel to subject themselves to video.

2. Writing, Reviewing, and Editing

Because the case writer was not a business professor, it fell to the academic director to choose the weekly topics and make an outline of the case. This meant that the academic director had to be very informed about the company, by phone and in person. In addition, before the case writer started gathering information related to a topic, each week the academic director provided the case writer a fairly detailed outline of the case. This guided the case writer in formulating interview questions for the company managers.

With an outline in hand, and with all the data gathered, the case writer usually spent Fridays writing the cases, which ranged in length from 3 to 10 single-spaced pages. Of course, this meant he would often have to miss events going on at the company that day, so again we have an argument in favor of hiring an assistant case writer.

The case writer would then forward what he had written to the academic director, who would edit the material, and usually add a page of two of his own to the case. By Friday night, the academic director would forward the draft case to the company CEO for approval. A response usually came before noon Saturday. If the response was a simple "All OK," the case could be posted on the course website immediately. If there were objections or corrections, the academic director would scramble to re-write, and post the case no later than 6:00pm. Only three times during the semester did the CEO request changes, and to us these changes seemed minor.

One might think that meeting the relentless weekly deadlines would be enough for the case team, but in fact much more was going on. Next we will review the "extracurricular activities" that enhanced the real-time case.

C. Producing Other Materials and Events

Studying a company in real time opened opportunities for learning and student engagement that can't be imagined in the traditional case context. For example, when using traditional cases there is no company around to which students can pose questions, or submit ideas. In contrast, the real-time case is an event, an experience for students because they are connected to the company. But without technology, the benefits of the real-time nature of the case could not be realized. In this section we will describe how students became connected to the case company and to each other via communications technology.

The most obvious way to connect students to the case company is through standard communications tools such as video conferences, phone conferences, and online chat. We employed each of these techniques at least once.

1. Video Conference

Our first thought was to start things off with a bang by holding a video conference during the very first week of the semester. We then decided that students would get more out of a conference if they had some background knowledge of the company's technology, so we waited until week four. By that time students had read the company's business plan, and had learned about the technology of chip design.

It turned out that we could not find a practical way of have an interactive video conference at eleven locations, so we settled for a taped video interview with the CEO. At the end of the semester all eleven campuses had access to a live voice conference on the web with the CEO using a service called Elluminate (IP telephony). Because of the availability of Elluminate, we did not use conventional phone conferencing, as we had done in 2001.

2. Online Chat

Another method for connecting students directly to the case company was online chat. We announced that for one hour on a particular night a COMPANY B manager would be available online to answer questions. This was done twice during the semester. As with other mediated interactions, the chats took place outside of class time. This meant participation was a fraction of class attendance, averaging around 10%. In the future we see no reason not to have at least an online chat session every week. If we assume that there are seven managers to handle the task, each manager would have to show up on line twice during the semester, not an undue strain.

3. Guest Speakers

The bulk of the "extracurricular" materials and activities organized by the academic director and described above fall into the general category of connecting students to the case company and facilitating communication. The case team felt that it could do even more than this to enrich the students' learning. One way was to bring guest speakers into the classroom.

Because the case company's technology was so challenging, faculty at several of the RTC sites found chip design experts to speak to their students. At the academic director's university, a professor of computer engineering actually sat in on every class, and gave invaluable insights into the case company. At Olin College of Engineering a professional chip designer sat in on each class, and was willing to provide input to the case production process

In addition to arranging industry experts to speak in classes, the professor at Clark University was able to get the CEO to visit his classroom.

D. Processing Student Questions and Recommendations

Video, phone, and chat are ways of *directly* connecting students to the company. But there are important *indirect* methods as well. There are two main goals of this indirect connection. The first is to convey student recommendations to the case company and the second is to answer the many student questions about the company that were not answered directly. As mentioned above, only a small portion of each

class participated in direct communication via video, phone, and chat. Also, these direct communications events did not occur weekly, leaving extended periods when many questions occurred to students. One of the best ways of sustaining student interest and engagement is to answer questions quickly when they arise. Students could post questions on the website, and the RTC staff would answer them. One of the academic director's research assistants spent about 10 hours a week on this job.

1. Processing Student Questions

Students at (name of the academic director's university withheld) had no difficulty getting answers to their questions, because their professor was also on the case writing team. However, the professors at the other schools did not have any more information about the case than did their students, so students had to look elsewhere for answers.

The logical way for students to get answers was to submit them on the case website. The case writing team either knew the answer right away, or was be able to find the answer from the case company. It then was posted on the website where everyone had access.

In the 2001 production of the real-time case the system to do this was not in place. Questions came to the academic director from a variety of sources - such as weekly papers from all the schools, conversations, and emails. Sometimes he tried to answer the individual student, and somewhere past the mid-point of the semester he created a file on the website that contained all the questions he had fielded, along with some explanations of other topics he felt might be helpful. An announcement was made to all students about this FAQ-type file, but there was never a proper, expeditious, highly visible and systematic way of processing questions.

In the 2004 production the case staff (a teaching assistant of the academic director) fielded student questions through the RTC website. In the center of the Course Content page students had a link named "Post Your Questions Here" from which they then could post new questions, post replies to other students' questions, and review responses from the case staff or other students. Over the course of the semester 22 distinct threads were created with a total of 34 replies, originating from 10 different source schools. The questions spanned a period of about 10 weeks starting the last day of September and ending the second week of December.

The case staff adhered to a 24-hour response time goal. Most questions were addressed in that period while those that required more research were given a preliminary reply and then a follow-up response when more information was gathered. Questions varied in complexity and some of the sources for response information included experts and professors in the field, written books and resources, online databases, the Internet, and a US patent official.

Overall, the process of addressing questions was a success. It was useful to have a single person in charge of finding and posting responses to student questions; to have a good writer who can deal with the at-times ambiguous or complex questions; and to maintain a standard of short response turnaround.

2. Processing Student Recommendations

One of the fundamental elements of the real-time case concept is the communication of students' ideas to the company. This sets RTC apart from the traditional case method, and it has the potential to increase students' motivation. A system was set up to provide student input to the case company. The system

agreed upon by all the RTC teachers was that a student (or student team) would be assigned each week to write a summary of the class's analysis of that week's case. This was a valuable exercise for the "reporter" for the week because it required the person to sort out an array of views and to distil them into a coherent presentation.

The summary papers from each class at the schools were then forwarded to the academic director. The papers were read by one of the case team research assistants who would evaluate them from a factual standpoint. He would give the author feedback on whether the paper contained any false assumptions or statements. Our idea was that this feedback would be valuable to students; it would not be as valuable as feedback from the company, but at least we could maintain contact and be sure students were not getting too far off track. After review and feedback, the papers were posted on the website, where students from all the schools could compare and contrast. Although this sounds like a good idea in theory, we have little feedback about whether students made use of it.

Once the academic director read the papers he had to decide whether to forward them to the case company. Unfortunately the CEO discouraged this. In general the papers did not get sent to the company, and both sides lost out: the company was getting less than it hoped in the way of good advice, and the students were feeling less connected to the company and less valuable as consultants. The papers were accessible to the CEO on the course website.

E. Facilitating Communication Among Students

In addition to connecting students to the case company, the real-time aspect of the case meant that students at a number of schools simultaneously studied the same thing. And because all the students used the same website to receive case material, the case team theorized that there would be opportunities for new types of cross-university communication among students. We still believe this is true, but more time and thought will have to go into the design of mechanisms to encourage it. From student surveys we learned that students are eager to have this kind of communication.

The most obvious mechanism for inter-school communication would be chat rooms or message boards on the course website. Another good idea would be to have students post on the website any research papers they might write about the case company. These ideas are examples of cooperative activity centered on an interest in the case.

1. Using Competition Among Universities as an Educational Tool

Another approach to both facilitate interaction among students and connect students to the case company was to sponsor competitions among the schools. Two such competitions were organized by the academic director, and it turned out to be an example of the intense student engagement and learning that is possible when a case study is developed in real time. The first competition was to analyze one of the weekly cases. The second was to come up with a name for the company's product.

During the week of Oct 17, students at all eleven universities participated in a contest to see who could write the best paper about how the case company should price its product. Students were free to submit the paper on an individual basis or as a team. The professor from each university picked the best paper from his class and submitted it to the case company for final judging. The prize was $500. Unfortunately the CEO was very slow in picking a winner (it took until the end of November), and gave little feedback on why he chose the winner. This was frustrating to a number of the students. Nevertheless, competition was keen and students worked hard to win, according to reports from professors.

2. Student Research Papers

The professor at any of the schools could have required his or her students to do a research paper dealing with some aspect of the case company. This would be in addition to the weekly case discussions. Several of the schools did so. All except the academic director's university were incorporating the real-time case into a course that included other material. This left little time for a case-related research paper. In the future, it may make sense to arrange a course where the case is the sole focus; in that situation a research paper could be fit in. Assuming that these papers would be shared with all students via the website, the amount of useful information available to students in analyzing the weekly cases would expand exponentially.

3. Trade Shows

As mentioned above, attending a trade show is one of the best ways to quickly get oriented to an industry. Some way should be found for the case writer to attend a trade show before the case commences, and a way should be found to get students connected to one during the semester. Of course, not all the students could attend, but some way could be found to deputize a few students to attend and gather information on behalf of the others. There was a single trade show for our case company, and unfortunately students could not attend because it occurred before the semester began. However, the case-writing team was able to attend. During the 2001 case, students competed to win an all-expenses-paid trip to a trade show at which the case company was in attendance. This yielded benefits for the case (Kilbane, Theroux, 2004).

F. Producing Materials and Communications for Faculty

All of the above activities by the case team were directed at enhancing the educational experience of students studying the real-time case. But the real-time case presented some unique challenges to the professors teaching it, and the case team had to consider their needs as well.

Unlike most courses, the professor did not have "the answers" before the students did. Professor and student got the same material at the same time. The good news is that this had the potential to forge a relationship between the two in which students and faculty became partners in executing the task of advising the case company. The bad news is that this partnership may not be comfortable to some professors, especially those with a strong need for control, or a strong need to impress, or a weak sense of security. Probably such professors would be better off not teaching a real-time case. But what could be done for a professor ready for the challenge and excitement of the new kind of teaching? And what can these professors contribute to the multi-campus RTC event?

Because the first production of the real-time case consisted of only four universities, one of which was the home of the academic director, it was possible for the academic director to maintain a personal dialog with the other three professors who utilized the real-time case in their classrooms. In general the academic director spoke on the phone or exchanged an email with the other professors every two weeks. But the 2004 case included 11 sites, and it was not possible for the academic director to give much individual attention, though he certainly tried.

Instead of individual attention the academic director sent the same email to the professors, usually one per week. What was the nature of this communication? In general the academic director shared insights with the other professors that he had gained about the company, but which were not written about in the weekly cases. Often this consisted of "human interest" tidbits that were too personal to be broadcast on the web. The academic director also shared his views about how to analyze the cases.

In sum, there was some informal, ad hoc support of the professors teaching the case, but nothing systematic. This was simply because the academic director lacked the time or resources. Most weeks, the case team was able to produce PowerPoint slides that summarized the technical notes that accompanied the cases. A full report on faculty experience in 2001 is published elsewhere [2]. A report on the faculty experience in 2004 is forthcoming.

G. Technology Issues

Nearly all of the communications described above were mediated. In the following section we review the challenges and benefits this presented. The RTC course content resided on a web "course platform" called Moodle (similar to Blackboard or WebCT). Moodle is an open access platform that is free. The following section discusses the technical issues faced during the course and the resolutions to these problems that the RTC team came up with.

1. Web Hosting Services

Web hosting service can be understood as the following: The RTC team produced text, video and PowerPpoint files that had to physically reside on a server; the information traffic to and from the server had to be managed, and all the technical problems that could affect that server (i.e. slow it down or shut it off) had to be managed. The web hosting company does all of these things. In addition, since RTC used Moodle as its course software platform, the web hosting company was also responsible for downloading and configuring Moodle to their server, enabling us to use the Moodle software to build our site.

Our initial web hosting company was Net Mondo. Net Mondo's down time turned out to be much higher than we desired, and its method of handling problems was through internet "complaint tickets" as opposed to phone contact. The turnaround time for "completing tickets" or fixing the problem was less than optimal for a course such as RTC. The RTC team decided to seek service from another web hosting company, initially as a backup for when the Net Mondo site was down. We chose Remote-Learner.net as this new hosting service. The staff at Remote-Learner.net was available by phone and was much more responsive to our needs. The downtime was less and speed of download was faster.

After experiencing the better quality of hosting by Remote-Learner.net, the main site was switched from realtimecasestudy.net using Net Mondo to realtimecasestudy.com using Remote-Learner.net. This was done by configuring the Net Mondo site to automatically link to the Remote-Learner.net site.

The experience gained by the RTC team regarding how to deal with web hosting companies and the knowledge that Remote-Learner.net provides quality service will serve future RTC teams well. It is likely that any future RTC courses put together by (University name) will use Remote-Learner.net

2. Internet Course Software: Moodle

Many software programs exist which purport to facilitate easy and effective internet course creation, and there likely will be more such programs in the future. These programs vary in their cost, ease of use, features, and presentation. In the months before the launch of the course, the RTC team evaluated several of these, finally deciding upon Moodle. Moodle had the following benefits: 1) it is free, 2) a number of web-hosting companies claim to know to host Moodle, 3) its layout and presentation is compatible with the needs of the RTC, and 4) the layout and details of the pages can be easily edited without requiring any programming knowledge. The drawbacks are: 1) in some instances, small details such as the wording of pre-set headings could not be changed, and 2) some features the RTC team would have desired did not

exist, i.e. Wiki and videoconferencing capabilities. Wiki is a type of page that is mainly text and in our case would serve as a medium for asynchronous collaboration between students. For example, work groups could have password-protected Wiki pages where they work from home but on the same page in an effort to complete the assignment. Wiki could also be used to facilitate online discussions spanning all involved schools. Videoconferencing capabilities would be used for videoconferencing.

It is likely that Moodle could be used successfully for future RTC productions. Moodle is an open source program that is constantly being updated with new features. Future releases of Moodle may contain new features that improve the student experience. However, since many other competing programs exist, the RTC team may discover a new program that serves its needs better. Features that have the potential to greatly enhance the RTC experience are those that facilitate easy and effective interaction of students through the site.

3. Student Payments for the Course

Students at all participating universities paid $60 each for the RTC material. To collect the money the RTC staff set up a Paypal account, and also set up a special e-mail address. Directions on how to pay were included in a link on the case website. When a student paid for the course, an e-mail notification was sent to the case e-mail address. In this way the RTC team was able to track who had paid. However, in some instances parents or spouses of the students made the payment on behalf of the student. When this happened, the RTC team would get the name of the parent or spouse and not the name of the student. This required the RTC team to e-mail the paying party to ascertain the name of the student. Teams involved in future productions of RTC should pre-empt this problem. The most likely solution, if possible, would be to include an additional field in the Paypal form for the student name.

4. Email Announcements to the Students

Email announcements sent to all students were created by posting a new message in the section of the case website called “Latest News”. The email received by the student includes only the students address in the “to:” line, maintaining the confidentiality of the students’ addresses. (Each student was given the option when registering to make his/her email address available to the other students or hidden from the other students.) However, some students did not enter valid e-mail addresses when filling out their profile. This resulted in delivery failure errors. The students’ professors were contacted and asked to have the student fill in their correct e-mail address.

5. Video Production

Video clips were created by the case writer using a digital video camera. The camera could later be plugged into a computer and Adobe Premiere was used to edit the clip and convert it into a file format compatible with running on a streaming server. Since video files are so large, using a streaming server helps the end user view the video more easily. The Windows Media program downloads a certain amount of the file (“buffering”) and then starts to play the video. As the video plays, the rest of the video file is downloaded. This streaming file originated from a server at the academic director’s university. The internet address for the file on the streaming server was linked to the case website. The student would click on the link and a new screen would pop up where the video would download and play.

H. Maintaining Relations with the Case Company

No review of what was learned about producing a real-time case would be complete without mentioning the process of maintaining the good will of the case company. This job fell upon the academic director

and the case writer.

It is essential to start the case production process with trust and confidence between the CEO and the academic director. The 2004 case began with what the academic director thought to be a strong relationship with the CEO. That relationship was then extended to the case writer, who had his desk in the office of the CEO. Unfortunately, by the end of the semester the relationship declined, as mentioned above.

From the outset there were clear groundrules for the engagement (available upon request). The groundrules dealt with the case writer's access to information, approvals required for talking with outsiders (customers, supplier, media, investors), confidentiality expected of students (available upon request), the approval process for unclear matters, the procedure for approving material posted on the course website, and space usage privileges for the case writer. These guidelines were followed carefully, and seemed to cover everything.

Although the academic director's university and the case Company Both made a commitment to proceed with the project, the academic director did not want to take for granted the company's cooperation. Accordingly, he took a number of steps to keep the cooperation strong. That cooperation started and remained strong in the 2001 case. In contrast, it was difficult to interact on a casual basis with the managers of the 2004 case company. The academic director tried whenever possible to make small talk and get to know the company's managers. And he would periodically ask them how they felt about the process of working with the case writer. The managers did occasionally have gripes. ("Why is he always trying to do interviews?") Attempts were made to fix things.

I. The Case Company's Evaluation of the Experience

One of the assumptions behind the real-time case is that the case company will benefit from participating in the case; it won't be a one-way street in which the students and universities get all the benefit.

Accordingly, an important component of the project evaluation would be a careful analysis of the case company's perspective on the case study experience. However, that plan changed when, near the end of the semester, it became apparent that the case company CEO was peeved, and he did not want to participate in any type of exit interview or evaluation. It appears that the CEO was upset that he did not get a finished business plan out of the RTC process. He believed, mistakenly, that a business plan was the quid pro quo for his participation.

J. The Economics of RTC

The greatest cost in producing the RTC is that of hiring a case writer. Gathering data for the real-time case requires that this person be present at the case company around 50 hours per week over a six-month period. The case writer gathers the data during all types of meetings while observing the company doing its business. The case writer can also take company managers away from their normal activity and schedule interviews. Obviously, scheduling interviews must be held to a minimum so that the case production process does not become too large a time burden on the company. The writer must have the skill to produce high quality material on a weekly deadline, the knowledge of business to sort out the wheat from the chaff, and a personality that can wear well on a wide variety of managers at the case company.

Such a person does not come cheap. In general a person meeting these criteria will be a mature professional with years of experience. Since many professors and students count on the writer to deliver a weekly case, in our judgment that it is not realistic to hire an unproven person such as a doctoral student. The ideal person would be a McKinsey consultant who is also an excellent writer. The anticipated cost would be over $30,000 per month. But other professionals, including free lance journalists, professors on sabbatical, or less prominent consultants might also do the job reasonably well. The going rate for such professional is around $10,000 per month.

In addition to funding the case writer ($60,000) money is needed to conduct video conferences ($8,000), phone conferences ($3,000), digital video equipment and software ($4,000), student research assistants ($20,000), travel ($4,000), and copyright fees for conceptual articles provided on the Web to students ($30/student). Of course, expensing the time of the academic director is also required. In the 2001 and 2005 cases the academic director received no compensation above his usual faculty salary.

It is certainly possible to produce a real-time case for less money than described above. And that would be desirable if the goal would be for many schools to produce such cases for their own students (not shared with other schools). The benefit of fewer schools per case is that the individual student might feel a closer connection to the case company. But we feel that in the early years of the real-time case that it makes more sense for one or two schools per year to produce a case with a high standard of quality (and cost). The Web makes it possible for an unlimited number of students and faculty to benefit from the effort of a handful of professional case producers.

The model of "few cases-many schools" also may be necessary to make the case production process independent of foundation support. If enough schools (around 70) adopt the case each year, student fees would be sufficient to cover the cost of producing the case.

VI. SUMMARY AND CONCLUSIONS

The real-time case study was provided to entrepreneurship students at eleven schools in the US, Canada, and Puerto Rico. The majority enjoyed that experience and found it superior to what they were accustomed at their school. Instructors as well valued the experience and are ready to sign up for the next case. Weighing against these positives is the fact that the quality of students' experience with the case was diminished by two factors: the extraordinarily challenging nature of the case company's product, and the less-than-satisfactory cooperation of the case company CEO. We have learned lessons that will help us realize the potential of the real-time case concept.

VII. APPENDIX A

Site	*Student Profile*	*Institution*
Site 1	13 MBA students	Clark University
Site 2	14 Undergraduate senior business majors	Univ. of Northeast Oklahoma
Site 3	14 High school juniors and seniors	Wilbraham-Munson Academy
Site 4	15 Undergrad engineering and business majors	Loyola-Marymount University
Site 5	25 MBA and undergraduate engineering students	Olin College/Babson College
Site 6	28 MBA, executive, and undergrad	Univ. of Mary-Hardin Baylor
Site 7	7 MBA students	Inter-American University (Puerto Rico)
Site 8	26 MBA students, part-time and full-time	Penn State Univ.
Site 9, Section 1	40 Full-time undergraduate students	UMass Amherst
Site 9, Section 2	13 Full-time MBA students	UMass Amherst
Site 10	34 MBA students, 4 were executives	Univ. of New Brunswick (Canada)
Site 11	16 Undergrad business majors	Univ. of Tampa

VIII. REFERENCES

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3. The U.S. Association for Business and Entrepreneurship (USASBE), the largest organization of professors of entrepreneurship, named the real-time case study as the Pedagogical Innovation of the Year in 2002. Sloan-C, a leader in the study and dissemination of best practices in online education selected the real-time case for "Best Practice for Student Satisfaction in 2002." The US Distance Learning Association (USDLA) is one of the three largest organizations focused on the development and improvement of online learning. In 2003 they designated the real-time case study for the Excellence in Distance Teaching Award.
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IX. ABOUT THE AUTHOR

James Theroux, Ph.D., is a UMassOnline professor of business. He is a recipient of the United States Distance Learning Association (USDLA) Excellence in Distance Teaching Award and of the Sloan Consortium Excellence Award.

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