Synchronous e-learning: Reflections and design considerations

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ABSTRACT

This paper is a personal reflection on the design, development, and delivery of online synchronous conferencing as a pedagogical tool complementing traditional, face-to-face content delivery and learning. The purpose of the paper is to demonstrate how instructors can combine collaborative and virtual learning principles in course design. In particular, the paper asserts that instructors should take into account relative advantage, compatibility, complexity, and risk attributes of new technologies before incorporating them to their courses. Further, it is important to evaluate organizational support availability such as financial resources and managerial support. In realizing team work for course projects that require group interactions, synchronous online conferencing can be very valuable, and even preferable, for students since it overcomes limitations of space, time, and distance. Future research should explore benefits, challenges, and outcomes of synchronous online discussions. Comparisons to implementation and design considerations of "asynchronous" virtual learning environments such as discussion board forums could be beneficial as asynchronous virtual discussions seem to be more commonly used in supplementing traditional course designs.

Keywords: Collaboration, Synchronous, Online Learning, Teaching Practice, Technology

INTRODUCTION

Technological changes in the methods used to deliver course content are becoming widespread in higher education. Computer-supported collaborative learning environments are allowing students to experience new ideas and different perspectives, and easily share their thoughts with other students (Dillon, 2008; Golden, 2006; Sullivan et al., 2011; Tabak & Nguyen, 2013). Yet, courses that involve an online learning component or those that are fully online or blended put different demands on the professor, many times changing his or her role to one of a tutor-facilitator (McFadzean & McKenzie, 2001; Ross & Rosenbloom, 2011) and posing challenges regarding the design, initiation, and implementation of online course components (Milwood & Terrell, 2005).

Although computer assisted teaching and learning or Internet based education is gaining acceptance as a supplement or an alternative to teaching and learning in traditional classroom settings, more research is clearly needed on its effectiveness in enhancing and supporting student learning (Lai, 2011; Nicholas & Wan, 2009; Ross & Rosenbloom, 2011). Most of the existing research is exploratory and in early stages of assessing the contributions of an online course component to the learning process (e.g., Arbaugh, 2000; Sullivan et al., 2011) as this is a relatively new method of delivering knowledge and creating an interactive learning environment. Yet, together with advances in technology, more opportunities are emerging for electronic collaboration, and in addition, there is research evidence that collaborative activities and learning

lead to better retention of content as well as to higher quality critical thinking and knowledge transfer (Pronovost, 2011; Sharon, 1990). Research further supports use of virtual classrooms for collaborative learning (Leidner & Jarvenpaa, 1995; Zhu, 2012). Use of advanced technological features encourages more student involvement and interaction in both synchronous and asynchronous contexts. Since computer assisted education overcomes limitations of time, space, and distance that may constrain collaborative activities within the physical classroom, virtual learning leads to enhanced collaboration and experiential learning (Erlandson, Nelson, & Savenye, 2010; McFadzean & McKenzie, 2001).

This paper discusses the design, development and implementation of online synchronous conferencing as a pedagogical tool. The purpose of the paper is to reflect on how instructors can integrate e-learning technology with collaborative learning principles to deliver content and enrich traditional course design. The framework of design considerations was based on initiation and implementation of collaborative Web-based technologies as guided by Rogers' (2004) innovation diffusion model and research.

REDESIGNING TWO MANAGEMENT COURSES

Course Objectives and Connections to Synchronous Conferencing

The courses that were central to this research were "Organizational Leadership" and "Management of Organizational Behavior" offered as part of a Management concentration under a B.S. in Business Administration degree. Both courses were under-graduate and senior level. The courses were also required (as opposed to being elective) for a Management concentration. An online synchronous conferencing activity was introduced to students enrolled in three sections.

"Organizational Leadership" course objectives focused on developing leadership skills, managerial leadership concepts and theories, research findings, and practical applications. It entailed group exercises and cases to illustrate practical applications. Course topics included participative leadership, leadership in decision making groups, and charismatic and strategic leadership in organizations. The course also covered points of convergence and divergence among different leadership perspectives, practitioner-oriented approaches for improving leadership effectiveness, and current issues in leadership. Course objectives also included students' developing and practicing skills required for effective managerial leadership at all organizational levels, and enhancing creative, critical and integrative thinking abilities.

By applying various leadership theories and concepts to real-life situations, the course focused on developing practical excellence skills. It further aimed at developing written, spoken, and electronic communication skills through Leadership-in-Action papers, team case presentations, and group and individual experiential exercises. One of the objectives of the course was to improve technology skills. Real-time (synchronous) discussions were added to the course site on Blackboard course management system to supplement this particular objective as well as to facilitate content learning.

"Management of Organizational Behavior" course was organized around the main topic areas of individual, group, and social processes and behavior, interpersonal processes and behavior, and organizational processes and structure. This was an experiential course, and so learning outcomes were achieved through several personal awareness and growth exercises, group exercises, and case studies. Course objectives included studying individual behavior in organizational settings through job design, decision making, quality management, motivation, and

performance management, interpersonal behavior through communication, conflict management, power/politics, and empowerment, as well as group behavior through intra-group and inter-group dynamics, and teams and teamwork. Another objective of the course was to enhance written and oral communication skills, ethical reasoning skills, creative, critical, and integrative thinking skills, and diversity management skills. The new e-learning course component was aimed at strengthening the collaboration skills of participants as well as enhancing their technology awareness and facilitating content mastery.

Design Considerations

Applying the teaching-for-learning model of Conrad, Johnson, and Gupta (2007), synchronous online conferencing was integrated into both courses. Teaching-for-learning model focuses on design of learning experiences that are responsive to learning outcomes. Accordingly, the teacher implements a teaching practice and collects feedback to re-align the teaching practice as appropriate. In both of the courses discussed above, enhancing teamwork skills and improving technology skills were two of the learning outcomes that needed to be addressed in course design. A teaching practice such as synchronous online conferencing involving both the use of online technology and student collaboration skills directly responded to the stated learning outcomes.

The choice of this specific teaching practice was further guided by research on technology diffusion (Rogers, 2004). Specifically, Rogers asserted that attributes of relative advantage, compatibility, complexity, divisibility (later revised as trialability), and communicability (later revised as observability) consistently influenced the adoption and diffusion of ideas, or practices new to the adopter. Extant literature on Rogers' typology focused on perceived innovation attribute effects on decision makers' adoption behaviors (Makse & Volden, 2011). Rogers (2004) in his review of past research in this area concluded that strongest support exists for attributes of <u>relative advantage, compatibility, and complexity</u>, "with somewhat weaker support for the existence of trialability and observability" (Rogers, 1983: 212).   Meta-analytic summaries can be found in Tornatzky and Klein (1982) and in Rogers (2004) across a wide range of disciplines.

Perceptions of the contributions of an idea to future performance refer to relative advantage (Makse & Volden, 2011; Rogers, 2004). The question is whether the adopters of the idea and/or practice perceive that there is an advantage to adopting the idea/practice. Relative advantage concept was evident in students' comments in both courses in their written assessment reports. Students clearly indicated that they prefer being involved in live chats over traditional teaching/learning methods such as writing term papers or making presentations of their research to class. One of the commonly expressed comments was that they felt they could express their opinions more freely in a virtual real-chat environment than in a face-to-face context.

High compatibility refers to perceptions of consistency with the values, experiences, and needs of the organization (Makse & Volden, 2011; Rogers, 2004). The new course component (teaching practice) of real-time conferencing was highly compatible with the current course structure and the structures of other business courses. Students had used Blackboard in other courses before and over 80 percent of all students indicated that they were familiar with the software. Many other tools of Blackboard were also in use such as the group Wikis, blogs, group asynchronous discussion boards, file exchange, and external links. Hence, since this technology was a tool available within Blackboard, perceptions of compatibility increased for the students. Also, the fact that they did not have to learn how to use a new software package contributed to perceptions of ease of use (Tabak & Nguyen, 2013).

Complexity is the degree to which an idea is perceived as relatively difficult to understand and use. When complicated ideas are introduced such that there are high levels of interaction with

various structural systems, adopters may perceive them to be less manageable (Rogers, 2004: 242). For example, it is relatively easier (and so less intimidating) to learn how to use a calculator than to learn how to use a tablet or iPad. Low complexity means the technology is better defined and poses high perceived control, low risk, and high predictability to the user. When online real-time chats were introduced in these course, the professor encouraged and reminded the students several times to enter the chat room and do trouble shooting before their scheduled chat times. A list of items to check for was handed to students and emailed as well. The objective was to enhance perceptions of control and lower perceptions of complexity.

Perceived risk was also considered as an attribute influencing successful new adoptions of technology. Research shows that if the innovation is perceived as less risky by adopters, probability of success improves (Tabak & Barr, 1998). Marketing research further provides support that perceived risk influences how consumers behave (Holak, 1985; Pi & Sangruang, 2011). When risk is assessed, it is important to evaluate how radical the change is in comparison to an existing system (Carlo, Lyytinen, & Rose, 2012). Routine changes, for example, are new, yet similar, to prior experiences (Tabak & Barr, 1999), involving less risk, while radical changes can involve higher risk as well as originality. In this case, the new pedagogical tool indicated a routine and incremental change. If the whole course had been put online and all face-to-face interaction had been eliminated, this would have been a radical change. Hence, perceived risk for adopters was relatively low.

Methods

Cross-sectional synchronous student discussion groups were randomly formed from the students registered for the two sections of the Organizational Leadership course and one section of the Management of Organizational Behavior course. Two (and sometimes three) students were chosen randomly from each one of the three course sections and these students were assigned to a team. Each team had six (and sometimes seven) students. Student teams met online at pre-scheduled times in a chat room. Students chose their own meeting time and date. Teams engaged in "live" real-time classroom discussions. The professor attended every session. The role of the professor was that of a facilitator in that she stayed silent most of the time and let the discussions evolve at their own paces. Discussions focused on pre-specified course topics that bridged or overlapped across the two fields of study (organizational behavior and leadership). Students had access to the discussion questions before the virtual classroom session both as a handout (hard copy) and online in Blackboard course sites. Discussion questions were put online in the Whiteboard area of Virtual Classroom in Blackboard before the meetings. There were two sets of discussion questions used in two separate sessions in the virtual classroom during the semester. Table 1 includes both sets of questions.

During the first set of virtual live discussions, team sizes were kept at six or seven students maximum. Teams consisted of five students each maximum in the second set of discussions. This resulted in 13 student teams (2 teams with 7 members; 11 teams 6 members) in the first set, each team meeting for at least 30 minutes. In the second set, 16 student teams, each with five members, participated in virtual live chats and sessions lasted at least 45 minutes. Students were teamed up with different students in each set. Meetings occurred outside of regular class meeting times typically during the weekends or evenings so that student work and school schedules could be accommodated.

Table 1. *Synchronous Online Conferencing Discussion and Assignment Questions*

Q #	Synchronous Online Conferencing Discussion and Assignment Questions Part I
1	Why should the average manager or any leader be well versed in the various motivation theories?
2	How have hygiene factors and motivators affected your job satisfaction and performance?
3	Do you know anyone who would not respond positively to an enriched job (that is a job enriched with more responsibility and decision making authority)?
4	Do you believe that job satisfaction is partly a function of both personal traits and genetic factors? Explain.
5	Do you believe job satisfaction leads directly to better job performance?
6	How would you respond to a manager who said, "Work-life balance is a personal problem that does not belong in the workplace. If you want to get ahead, be prepared to work a lot of hours and don't complain."
7	What are the main advantages and drawbacks of the trend toward increased delegation at the workplace?
8	In your opinion, how much empowerment is "too much" in today's workplace?
9	Will empowerment turn out to be just another management fad? Explain your rationale.
10	How would you respond to a manager who said "Employees cannot be motivated with money"?
11	How would you respond to the following statement: "Whenever possible, managers should hire people with an external locus of control"?
12	Is everyone cut out to be a leader? Explain.
13	Has your college education helped you develop any of the traits that characterize leaders such as assertiveness, communication and cognitive skills, internal locus of control, self-confidence, initiative, ambition?
	Synchronous Online Conferencing Discussion and Assignment Questions Part II
1	What role do emotions play in decision making?
2	Given the intuitive appeal of participative management, why do you think it fails as often as it succeeds? Explain.
3	Do you think you are creative? Why or why not?
4	What advice would you offer a manager who was attempting to improve the creativity of his or her employees? Explain.
5	Considering your current lifestyle, how many different roles are you playing? What sorts of role conflict and role ambiguity are you experiencing?
6	Have you observed any social loafing recently? What were the circumstances and what could be done to correct the problem?
7	Why is delegation so important to building organizational trust?
8	Would you like to work on a self-managed team? Explain.
9	How would you respond to a manager who said: "Why should I teach my people to manage themselves and work myself out of a job?"
10	What bases of power do you rely on in your daily affairs? Do you handle power effectively and responsibly?

In both sets of sessions, the total number of students participating in the research was 80 students. Hence, in the first set of sessions, 13 student groups participated at 13 different times

during a two week time span. The discussion questions were selected randomly from the list of 13 questions displayed in Table 1. In the second set of sessions, 16 student groups met at 16 different times during a two week span, and again, the discussion questions were randomly selected from the list of 10 questions listed in Table 1. After each one of the session sets, students individually completed a report answering each one of the 11 questions displayed in Table 2 for session 1 and the 6 questions displayed in Table 2 for session 2.

Attendance in the virtual chat twice and turning in the reports that provided answers to all questions by the deadline was worth 20 points for each session. Thus, a total of 40 points (10%) of the course grade came from attendance in the chat sessions and the quality of the assessment reports turned in by students. All assessment reports were graded.

Organizational Support

Implementation of the new teaching practice emphasized framing and environment (Johnson, 2000). Framing strongly implies effectively managing the perception, understanding, and interpretation of messages. Good framing results in a high level of communication quality. As for synchronous online conferencing (or live real-time chats) and framing it for relevant stake-holders, the new pedagogical tool was posed as a method that will potentially contribute to students' multi-faceted experience in the courses. Main target consisted of two different stakeholders. One was the peer group involved in teaching similar business administration courses. A faculty development and research committee comprised of one faculty representative from each of the five departments in the College approved the new pedagogical tool and awarded a summer teaching grant that enabled the implementation of the innovation in the upcoming fall semester.

The second stakeholder group consisted of students who were going to participate in the use of the new pedagogical tool. The professor was highly engaged in communicating the benefits of the tool for the students and clarifying points of confusion. The course syllabus, Blackboard announcements, multiple emails as well as verbal short meetings were widely utilized to explain how the new tool was going to be implemented and how student performance was going to be assessed.

The environment must also be supportive and encouraging for successful initiation and implementation of interventions. Climate for change, managerial support, and financial resource availability are influential factors in how successful change would be (Klein & Knight, 2005). In this particular case, by making financial funds available for the technology enhancement awards, the Dean's office was showing full support and encouragement for such online initiatives. The College climate was such that faculty on the cutting edge of technology use in classroom and in research were being rewarded in various ways. Teaching technology grants was one of the channels through which this support was shown.

EFFECTIVENESS OF IMPLEMENTATION

Student performance on assignment reports was the main measure of implementation effectiveness. Both reports required students to use the virtual live chat/discussion content and structure. In the first report, completed after the first set of sessions, students gave feedback on what they would change structurally in the way the new pedagogical tool was utilized to make it more user-friendly and easier to use. They also discussed what they thought about such online learning tools and whether they should be more fully integrated into course design. Students also commented on whether such online tools should replace face-to-face classroom discussions.

Students further elaborated on what they thought about interacting with other students who were not in their class. After the second set of chat sessions were completed, the assessment questions asked students whether their thoughts have changed after exposure to others' views on these topics. In the assignment, students wrote what they thought about at least four of the content (discussion) questions before and after the chat room experience. Table 2 includes both sets of assessment questions.

Table 2. Synchronous Online Conferencing Assessment Questions

Q #	Synchronous Online Conferencing Assessment Questions - Part I
1	Which session did you attend? Write the date and time.
2	Did you find the chat room interaction useful? Why/why not?
3	What was the topic of discussion? Explain completely what was discussed.
4	How did the discussion go? Did you get a chance to speak your mind?
5	What would you change structurally for your second virtual meeting? Explain specifically. For example, did it work to split up to two groups and allow only 6 students maximum to talk simultaneously?
6	What would you change content-wise for your second virtual meeting? Explain specifically. For example, would you add Web pages to initiate discussion? What areas in Leadership or Organizational Behavior most interest you?
7	Do you think that online learning tools like this can be more fully integrated into traditional course designs? How?
8	Do you believe that virtual interaction can or should one day replace face-to-face interactions in a traditional classroom context? Why/not?
9	Do you have any ideas on how to make the scheduling task more efficient for the next meeting?
10	Did you find it useful to interact with other students who are not in your class? Why/not?
11	Please add any other thoughts that you think would be relevant and useful for improving the outcomes of this new teaching practice.
	Synchronous Online Conferencing Assessment Questions - Part II
1	Refer to the Virtual Chat Discussion Questions Part II. Respond in detail to four of the questions that were discussed in your virtual classroom session II.
2	In answering these questions, first type the question out and then put your response to it underneath. In your answers, first explain what your initial thoughts were about this question.
3	Then, explain how and /or whether your thoughts changed or expanded after exposure to the views of others in the chat room.
4	Finally, explain what you now think about the issue raised in the question after incorporating others' perspectives.
5	Repeat steps 3, 4, and 5 for each one of the four questions.
6	Finally, add a feedback paragraph to the end of your report assessing the effectiveness of Virtual Classroom and how it could be improved to be an integral of any organizational behavior or leadership course.

Feedback was very positive and constructive in general, and most suggestions were implemented in the second set of sessions. As a result, the meeting times were extended to 45 minutes from 30 minutes and the group sizes were limited to 5 members maximum. Also, the professor started scheduling the sessions at least 2 weeks before to accommodate scheduling difficulties and allow more time to plan. Further, only one chat session per day was scheduled due to technical challenges experienced by students from having too much material on the buffer when several chats take place on the same day.

As a result, this project further identified variables that would influence the effectiveness of online synchronous conferencing as a course component. These are group size, flexible scheduling, and technical difficulties. Figure 1 exhibits these variables as moderators of the relationship between adoption and implementation. Also shown in Figure 1 is the feedback loop from implementation to adoption. The feedback loop represents how information was integrated back into the course and how changes were made in the second set of virtual conferences.

Figure 1*. Collaborative Teaching Technology Adoption Process*
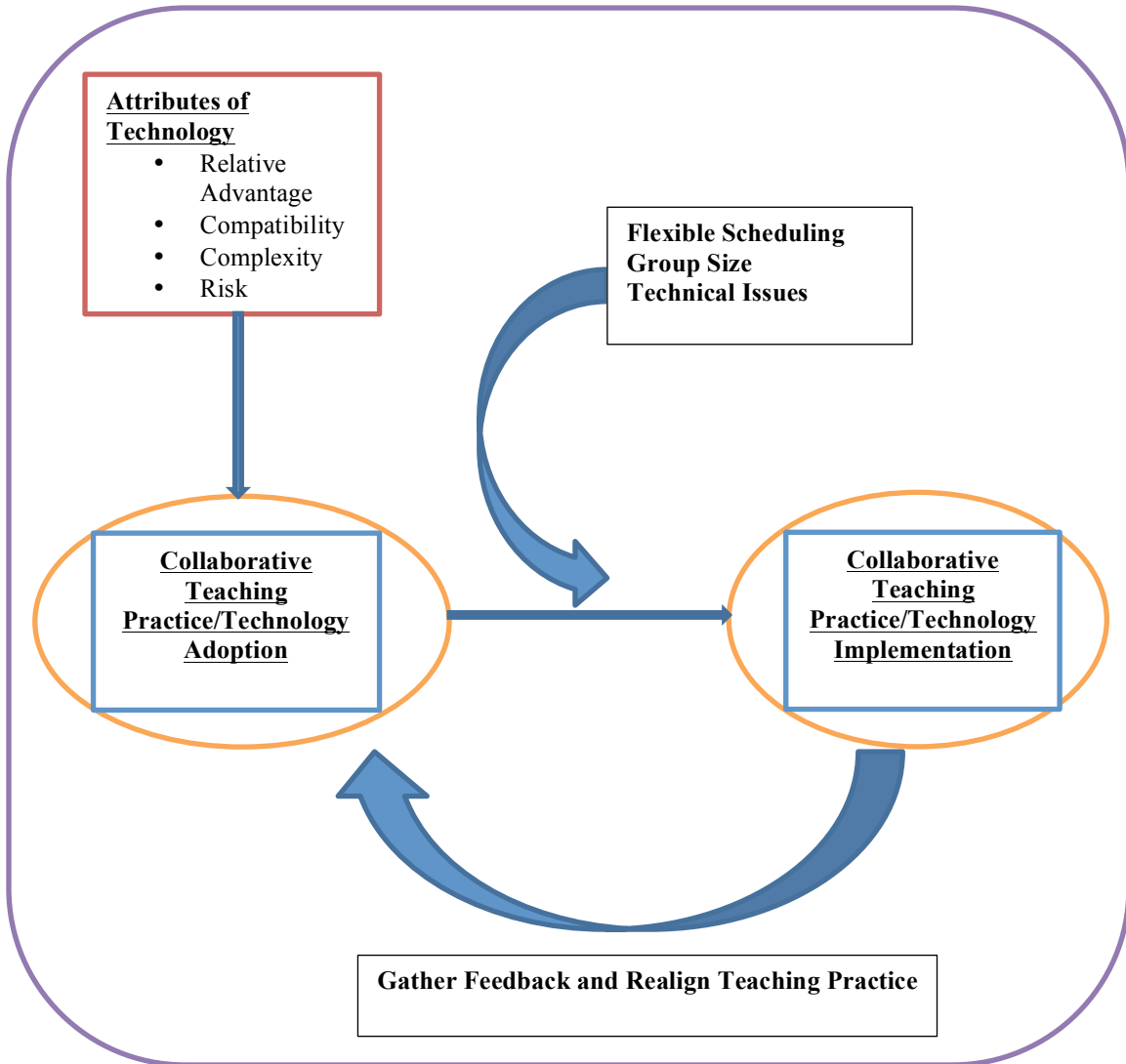
Just as there is an ideal group size in face-to-face group experiential exercises, there seems to be an ideal group size in online group work as well. During this exercise, when the group size increased to six or seven in the first set of chats, discussions in the chat room became quite chaotic; that is, it was difficult to follow who said what, and private conversations emerged. On the other hand, in cases when there were three or two members only in the chat room, discussions

and conversations quickly ended and the richness of exchange that would normally be present in larger groups was not attained. This exercise indicated a group size of four or five as optimum for high quality exchange of ideas and improved learning outcomes. This finding is consistent with prior research which indicates that as the number of members in a group increases, communication as well as the process of reaching a consensus becomes more difficult, and cliques may tend to form (Hill 1982; Shull, Delbecq, & Cummings, 1970). Hence, teams must be small enough for effective participation and bonding among their members (Trent, 2004).

Scheduling the meetings around busy schedules of students was another big challenge since the chats were conducted outside regular class time. Several options including weekends and evenings were offered. Still, it was difficult to coordinate so that four or five students sign up for any particular session. Also, when two or more sessions were scheduled for one day, the later meetings did not move swiftly as there was too much material kept in the buffer. This slowed the appearance of comments on the screens. It also made the screen blink every time a new comment was added to the common public chat area. This may be due to the limitations of the version of the software used. In summary, flexibility in scheduling was a factor in student satisfaction with the overall implementation of the new practice. This is consistent with research on flexible work scheduling in terms of its impact on work outcomes. For example, a meta-analysis found that flexible work arrangements positively impacted employee performance, job satisfaction, and absenteeism (Baltes, Briggs, Huff, Wright, & Neuman, 1999).

Several students had technical difficulties in logging into the chat room at their designated times. These either had to do with problems in their computers, or in their connections to the Internet. Make-up opportunities were provided for these students. These are technological issues to take into consideration when attempting to incorporate any online learning component to course design.

All students indicated that they found the chat room interaction very useful and that they each had a chance to express opinions and discuss the issues presented. In each chat session, the professor was present and was able to observe the high level of interaction and great interest from students as a silent observer. All students reported that online learning tools like this one can be more fully integrated into traditional course designs, but a majority expressed that virtual interaction should not one day completely replace face-to-face interactions in a traditional classroom context because the richness of interaction, such as the nonverbal cues (facial expressions, tone of voice, body language, and so forth) would most likely be lost.

DISCUSSION

This paper described the initiation and implementation steps involved in the use of synchronous online conferencing as a course component and delineated the design elements and principles that instructors should consider before implementation. The paper further identified variables that may have a potential impact on the implementation and use of this technology application in course design. Implementation of synchronous chatting was new for both of these courses and the students. Based on this premise, this paper focused on design considerations for implementing technology based new teaching practices. Since the development of design considerations is theory-driven based on research in innovation diffusion literature and partly on research in group dynamics and work scheduling literatures, same considerations should be applicable to new teaching and learning practices in other academic contexts.

The objective was to identify design factors that would enhance learning in a collaborative learning environment and to have students experience "live" classroom discussions on course topics. A virtual learning environment was expected to enhance creativity in critical thinking by

providing an online opportunity for exchange of different views on course topics. The student was to further experience synchronous online conferencing.

Numerous innovations and new practices fail due to little consideration of a variety of success factors contributing to initiation and design stages of development. New practices may either be perceived as too complicated and risky or they may not be seen as having any significant advantage over, or compatibility with, the existing systems. Sometimes, it may just be that they are viewed as difficult to manage. Instructors should take into account relative advantage, compatibility, complexity, and risk associated with designing, initiating, and implementing new teaching practices.

The new teaching practice fulfilled the course goals of learning, developing, and practicing technology and electronic communication skills required for effective managerial leadership, enhancing creative, critical and integrative thinking abilities through collaborative analysis of effective and ineffective managerial behaviors, and applying leadership and organizational behavior concepts to real-life situations, and developing practical excellence skills by use of discussions and learning in teams. Students, in their assessment reports, clearly stated that they learned from other students' comments and were pleased to have the opportunity to exchange views on various course topics freely. Students seemed to relate the course topics on subjects such as stress, motivation, leadership, and personality during their chats to organizational examples and examples from their real-life work experiences. They were able to simulate how the discussion would have been in a face to face classroom context.

Most students stated that despite all the benefits they perceived they would prefer the new tool to remain as just a small part of the course rather than switch to an all online structure. Many students also indicated that synchronous chats allowed them to freely express their ideas without feeling the anxiety of public speaking in front of a whole class. Several comments emphasized that the environment was more relaxed than in a traditional classroom. In fact, there is evidence suggesting that the anonymous nature of an online classroom environment may be more accommodating for some students (Sullivan, 2002) and that it changes the social psychological dynamics of the learning environment in powerful ways (Kiesler, Siegel, & McGuire, 1984).

CONCLUSIONS AND FUTURE RESEARCH

In general, face-to-face discussions may be preferable and more easily carried out than online synchronous discussions; however, there are a few instances where designing synchronous discussion contexts and incorporating them into courses may be important. First, they can be an integral part of a completely online course where students do not meet face-to-face at all or meet rarely as in hybrid courses. Especially in order to realize team work for course projects that require group interactions, synchronous online conferencing can be very valuable. Second, many times in the management discipline, classes require group work outside of regular class meeting times. Students may find it preferable to get together online even if it is for a brief period of time to coordinate and organize their group efforts. Hence, it overcomes limitations of space, time, and distance for collaborative activities. Third, rather than replacing face-to-face class or group discussions, online synchronous conferencing can be used as a supplement to traditional classroom teaching and learning techniques.   To that end, open distance and e-learning platforms can benefit from incorporating our design suggestions into course development targeting online learners.

One limitation of this exercise was that the feedback assignments about the new practice effectiveness were not anonymous and they were graded. Although this would have led some

students to provide positive feedback even if they thought otherwise, the questions were designed to elicit responses on improvement of the practice rather than asking for a straight positive or negative assessment. Many times during the semester, the professor also emphasized that students who provide constructive and thoughtful comments in their assignments about the new teaching practice would be rewarded. Future research should assess effectiveness and student reactions by use of a questionnaire before and after implementation.

Obviously, there are significant benefits, challenges, and outcomes of synchronous online discussions. Future research should compare and contrast implementation and design considerations of synchronous online learning with asynchronous online learning environments such as discussion board postings, as very commonly used in supplementing traditional course designs. A fruitful avenue of future research can be to investigate the advantages and disadvantages of using both synchronous and asynchronous learning through experimental design.

One other factor to consider as a moderator in the design of any new teaching practice and its implementation is awareness. For example, in this project, some students indicated that they were familiar with chat rooms and virtual classrooms while most have not used them before. This may have influenced their perceptions of the new practice. Hence, awareness can be measured as a control variable or a moderating variable of the relationships between adoption and implementation during the pre-test phase of future studies.

Future research should also conduct experiments that compare effectiveness of and student reactions to online versus face-to-face discussions on course topics. Stronger evaluations may result from comparisons of outcomes of two or more groups that are assigned to the synchronous, asynchronous, face-to-face discussion groups.

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