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Increasing Student Discourse to Support Rapport Building in Web and Blended Courses Using a 3D Online Learning Environment

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This article presents research conducted between 2002 and 2007 that examines user discourse, message flow, and exchange frequency in Web-only courses, blended courses, and then the same types of courses extended with a 3D online learning environment. The purpose of this study is to examine the impact that a 3D online learning environment has on discourse with Web-only and blended courses. Findings from this study suggest that the addition of a 3D online learning environment to both Web-only and blended courses demonstrates the ability to more rapidly create rapport among users, which translates into accelerated discourse that occurs earlier in and sustains itself longer and throughout the semester.

INTRODUCTION

Internet-based courses continue to receive widespread acceptance and deployment for creating and supporting learning activities across disciplines within education (Hill, 2001; Kazmer & Haythornthwaite, 2004). Universities commit vast amounts of money and resources to create online content to reach their students. Over 90% of universities in the U.S. that support distributed learning programs use some form of text-based communications to distribute course information or content (Jones, 2008). The arguments for supporting these programs range from cost savings to increased access for students and even profit for universities that make the investment (Moore & Kearsley, 2005; Ruth, 2006). The number of students at the university level receiving education from Internet-based solutions will continue to grow

(Arbaugh, 2000; Paulsen, 2003). This same approach is now migrating to high school course delivery as well (LAVA, 2005; Thomas, 2002).

The most common form of Internet-based communications used for course delivery is the World Wide Web (WWW). While this medium offers a familiar approach, it also suffers from three main shortcomings. First, research indicates that user and instructor satisfaction may not be as strong as some proponents had expected (Hill, 2001; Ruth, Sammons, & Poulin, 2007). Second, the minimum time and amount of text-based discourse necessary to achieve high-quality depth of communications between users in a text-only setting, particularly via e-mail, is significant (Jones, 2001). Third, online discussion forums require an effective design to achieve successful discourse (Guzdial & Turns, 2000; Polin, 2004), and placing text-based discussion into a course is not normally effective by itself. These shortcomings exemplify why only 36% of faculty at public institutions indicate overall positive acceptance of online education programs (Allen & Seaman, 2005).

When exploring the effectiveness of Web-only solutions primarily dependent upon text-based tools for communication, reviewers consistently criticize the lack of pedagogical tools available to support rapport development (Bonk & Dennen, 2003; Liu, Lee, Bonk, Su, & Magjuka, 2005). Rapport is an establishment of mutual communicative trusts between users that subsequently result in the achievement of high-quality communication. The creation of rapport within the first few weeks of a course impacts perceived satisfaction, depth of discourse, and student ownership (Gilbert & Moore, 1998; Woods & Keeler, 2001). Although rapport generation is possible by way of system enhancements to Web-based courses, many of these enhancements do not scale well, which eliminates those students located on the wrong side of the Digital Divide (Benton Foundation, 2007). Institutions also use other approaches that bypass technology in order to create rapport. This is evident in blended courses as well as programs that group students together into cohorts. The term blended, or hybrid learning, describes when a faculty member utilizes a mixture of face-to-face and Internet-based synchronous and asynchronous tools (Starr Roxanne & Murray, 2005). Separately, cohorts allow students to progress through courses together and extend contact over months or years (Brooks, 1998). Both approaches assist in the creation of rapport through either initial face-to-face or extended contact.

The primary focus of this article is on research conducted between 2002 and 2007 at a Sun Belt, mid-sized university in the southwestern United States. This study compares the quality of discourse between the two main online course delivery methods used – blended and Web-only. Researchers then examined similar courses, which were extended by the use of a 3D online learning environment. The article explores the 3D online learning environment's impact on the creation of rapport and course discussion.

Rapport, Immediacy, and Familiarity

Rapport is one of the most important features or characteristics of human interaction. It is the perception of being in "sync" (i.e. on the same "wavelength" as the person with whom you are talking) (Tickle-Degnen & Roseenthal, 1990; Wikipedia, 2007b). Experienced communicators understand the importance of maintaining rapport in online teaching and training (Hutchins, 2003; Online Training Directory, 2007). A study completed in 2004 showed that rapport could be established in face-to-face settings in just the first few minutes of an encounter and that the creation of rapport held positive benefits (Rhodes, Vieth, He, Miller, Howes, & Bailey, 2004). Similarly, the term "immediacy" is used in educational research to define the psychological distance between communicators (Swan, 2002; Weiner & Mehrabian, 1968). Educational researchers have found that both teachers' verbal rapport/immediacy behaviors (giving praise, soliciting viewpoints, humor, self-disclosure) and their non-verbal rapport/immediacy behaviors (physical proximity, touch, eye-contact, facial expressions, gestures) can raise rapport and can lessen the psychological distance (immediacy) between teachers and their students, which leads to improved learning (Christophel, 1990; Gorham, 1988; Rodriguez, Plax, & Kearney, 1996; Swan, 2001). The term "familiarity" in regards to memory has been used in different ways by different theorists to refer to retrieval process or memory assessment, different types of mnemonic information or subject states, or to refer to a specific memory storage location (Yonelinas, 2002). In education, the term familiarity refers more often to being able to place or have previous experience with something or someone. Izard (1990) states that rapport is dynamic and can best be defined as stages of relationship. For this article, we will use the term rapport to reflect the concepts of rapport, familiarity, and immediacy. Familiarity and immediacy are elements of rapport and the level or stage of rapport is defined by these concepts and descriptions.

The Importance of Rapport in Online Interactions

Mak and Yeung's (1999) investigation of elements of online communities show that online communities share many characteristics with traditional communities, including the necessity to create rapport in both face-to-face and online instruction. Jones (2001) found that e-mail groups were more successful in creating and maintaining long-term content exchanges when participants used repeated rapport elements throughout the electronic communications (i.e. salutations, personal inquiry, etc). Smolensky, Carmody and Halcomb (1990) showed in a study that rapport (familiarity) among group members (non-acquainted vs. pre-acquainted) did have an influence on use of language in a computer mediate communications (CMC) environments. They found that pre-acquainted groups were less argumentative,

were uninhibited in speech acts (language), and focused best on definitive solution tasks. Similarly, a study by Mukahi and Corbitt (2004) examined rapport (familiarity) and its impact on online interactions. They found that participants who were familiar with each other prior to the communications had an enhanced CMC experience. Yungbluth and Bertino (1996) show that "messages pertaining to well-wishing, teasing, social support, and agreement without elaboration are all instances of rapport building" (p. 12).

However, it is important to note that the socio-technical structures of e-mail groups, chat messages, and forums alone are not sufficient to build a long-standing rapport for the development of free-standing communities of practice (Kling & Courtright, 2004). Barab, James, & Moore's (2001) study of the Inquiry Learning Forum at Indiana University noted that despite the presence of numerous technological affordances to support social interaction, the participants failed to achieve the level of cohesion necessary to build a community that would continue beyond the length of the grant support and presence of project staff.

Potentially more important than the instructor-to-student rapport is social presence or rapport among the students as a group (Picard, 1997; Rice, 1992; Short, Williams, & Christie, 1976). Richardson and Swan (2003) explore perceptions of social presence among students enrolled in online courses. They found that students' perceived learning, satisfaction with instructors, and perceptions of social presence were all highly correlated. They also found that students' overall perception of social presence was a strong predictor of their perceived learning in the courses. Another study conducted by Picciano (2002) relates student perceptions of social presence to actual and perceived interactions and learning in an online, graduate-level course in education. Picciano analyzes the relationships among survey data on students' perceived social presence, learning, and interaction as well as their actual interactions in course discussions and performance scores on exams and a written assignment. He found that perceptions of social presence were correlated with perceptions of learning and interaction. However, only the students participating in the highly interactive groupings had significantly improved performance on the written assignment. Picciano's discussion of his findings links these outcomes to the potential for interactions in online discussion to support complex understanding, divergent thinking, and the development of multiple perspectives.

How is social presence and its accompanying sense of rapport generated within courses? For face-to-face and blended courses, the time spent in direct contact with the instructor and students has been shown to be responsible for much of the development of this social construct (Major, 2001). For online courses, the concept of virtual learning communities is used to facilitate its development. However, while the definition or concept of a virtual learning community is broad and diverse (Cutler, 1995; Haythornthwaite,

2002; Moller, 1998; Rourke, Anderson, Garrison, & Archer, 2001; Swan, 2003; Wikipedia, 2007a), for this article, we frame the concept of virtual learning communities using a hybrid of definitions from Nolan and Weiss (2002) as well as Rovai (2002). These authors define virtual learning communities as the intersection of the social organization of an environment and the activities expected and conducted by participants in a particular setting. Rovai defines virtual learning communities as the intersection of four components that include interaction, trust, learning, and spirit, which is the recognition of community membership. In this context, we examine rapport in two traditional course delivery settings to measure its presence. Then, selecting the specific virtual learning community mechanism of a 3D online learning environment, we examine how rapport is impacted when these courses are further supported by this technology.

3D Online Learning Environments

3D environments provide users with educational resources that are stimulating, appealing, easy-to-use, and educationally sound without the need to develop highly elaborate technical skills (Jones, Morales, & Knezek, 2004). Proponents suggest that such technology is well-suited to appeal to future user populations when applied in a presentation and learning context (Abram & Luther, 2004; Branston, 2006; Dede, 2005). A 3D online learning environment (OLE) is a specific combination of tools, interactions, and 3D multi-user environments (CRG, 2005). While the 3D interface and multi-user interactions can be compared to *Second Life* (Linden Labs, 2003), *World of Warcraft* (Blizzard, 2007; Dickey, 2007), Active Worlds (Mauz, 2001), or the AET Zone (Cox, 2006), a 3D OLE provides an integrated set of unique tools, all of which are intended to make the learning experience seamless to the student. The differences between 3D chat space or social game (massively multiplayer online social game, or MMOSG) like *Second Life* and a 3D OLE are the presence of tools beyond the 3D immersion and social interaction that directly support learning affordances. These in-space interfaces directly support formal learning in the environment.

Each system facilitates the creation of context developed to act as cognitive scaffolding. This acts as a means to foster engaging, immersive user interaction (Jones & Bronack, 2006; Norman & Spohrer, 1996). In a shared 3D environment such as a school building, park, or museum, users assume control of an avatar, or virtual-self. Communication occurs via text, full-duplex audio, overheads, whiteboard, and other collaborative tools. 3D OLEs provide highly collaborative, immersive 3D spaces that promote learner-centered interactions.

Furthermore, by providing a number of communication tool choices, students and instructors can use different tools depending on the set of tasks or personal preferences. This can increase the likelihood that all students,

regardless of learning style, will receive an equal opportunity to generate constructive rapport. Students and teachers frequently comment that they feel more engaged when interacting with one another within 3D systems (Jones, Morales, & Knezek, 2005). In other words, walking within the environment and talking with other users provides the most effective means of gaining situational awareness (Prinz, Pankoke-Babatz, Grather, Gross, Kolvenbach, & Schafer, 2004). In addition, research suggests that students using 3D environments maintain higher levels of motivation, increased interactions, and improved academic efficacy (MUVEES Project, 2003).

Figure 1 presents a screenshot of the environment used for this research that includes a physical environment within which learners collaborate online. The Created Realities Group's (CRG, 2005) 3D OLE was chosen because it supported a number of critical elements at the beginning of the research in 2003. These included support for both Macintosh and Windows OS, the ability to log all actions in the environment for later analysis, provisions for an immersive environment without the need of high-end video graphics card available to participants, and the authors' complete access to the development in order to further customize the software as needed to support research.

Figure 1. Example of the university environment.

QUALITY OF TEXT-BASED DISCOURSE IN RELATION TO COURSE DELIVERY METHOD

The primary objective of the study is to explore the quality of online communications as defined by method, message flow, and message discourse between users (Harris & Jones, 1999) of two types of course delivery methods that primarily use text-based interaction and compare the same form of courses to a 3D online learning environment. The major question this study examines is: How does the text-based communications change? While several different forms of communication (text-based, audio chat, in-person) occurred in all four types of course delivery, text-based communication was the single method that could be measured. The researchers examined four Web-only courses that used text-based communications exclusively as well as four courses utilizing a blended delivery approach with text-based communications. Subsequently, a 3D online learning environment was added to eight additional courses – four Web-only and four blended – for the entire length of the course in order to examine the environment's ability to extend the nature of communications beyond their primary delivery approaches.

PARTICIPANTS

Two hundred and fifty graduate students participated in the twelve courses taught between the fall 2002 semester and summer 2007 semester. Over 50% of graduate students in the courses were employed educators taking college courses. A majority of students were working towards a master's degree in computer education. The average age of the students was 33. Over 90% of students who participated reported that they felt comfortable with taking an online course, and all had taken some form of online course in the past two years at the time of the study course. Many of the students reported that they worked full time and were taking courses that fit their schedules. The number of students reporting that they played computer or video games increased from 25% in 2002 to 45% in 2007. The number of students reporting technology concerns with using the CRG 3D OLE decreased from 7% in 2002 to 2% in 2007. Student access to broadband Internet increased from 60% in 2003 to 95% in 2007. This is more than 10% above the national average for the same time period (FCC, 2003, 2007). All other students with Internet access at home reported dial-up access of at least 28.8Kbps.

COURSES

A total of 16 master-level courses were included in the study presented in Table 1. In the context of our research, the 16 courses can be grouped as follows: four courses using a Web-only delivery method (learning management system, or LMS), four courses using a blended delivery method, four Web-

Table 1
Courses Examined in Study by Method

Year	Course	Method	Students	Name of Course
2002	5400	LMS	21	Educational Telecommunications
2004	5400	LMS	14	Educational Telecommunications
2004	5400	LMS	14	Educational Telecommunications
2002	5610	LMS	16	Analysis of Research in Educational Technology
2002	5100	Blended	17	Educational Programming Languages
2003	5420	Blended	23	Web Authoring
2005	5420	Blended	13	Web Authoring
2006	5420	Blended	9	Web Authoring
2003	5100	LMS + 3D OLE	18	Educational Programming Languages
2006	5400	LMS + 3D OLE	26	Educational Telecommunications
2007	5400	LMS + 3D OLE	23	Educational Telecommunications
2006	5610	LMS + 3D OLE	10	Analysis of Research in Educational Technology
2004	5100	Blended + 3D OLE	12	Educational Programming Languages
2005	5100	Blended + 3D OLE	11	Educational Programming Languages
2004	5420	Blended + 3D OLE	12	Web Authoring
2007	5420	Blended + 3D OLE	11	Web Authoring

only method extended using the 3D OLE for the entire semester, and four blended method were extended using the 3D OLE for the entire semester.

Three factors characterized the selection and availability of courses used in the study:

1. courses taught by the same instructor
2. courses scheduled to be taught within the existing degree program
3. courses not altered from their normal design

Course content was consistent throughout the various delivery approaches so that a comparison could be made. Course duration was 16 weeks during the fall and spring, or 10 weeks in the shorter summer semester. All courses in this study received the same curricular structure. The format included:

1. situated mastery learning instruction
2. four main assignments
3. a midterm exam
4. a final project
5. equired e-mail based discussion

There are several techniques for increasing and maintaining high amounts of student participation in text-based course discussions; however, the selected method for these courses was a requirement of a minimum number of postings related to assignments (Bonk & King, 1998; Klemm, 1998). This method reduces the chances of having a large number of "lurkers" – individuals who read postings but do not participate in discussion – without taking grading emphasis away from the core course objectives (Klemm, 1998). Students in all courses were required to post a message regarding an assigned topic question related to the course content and also reply back to two other student postings in a meaningful manner. The instructor was active in all text-based exchanges with a goal of responding to all text-based messages within 24 hours of student submission.

Blended Courses

The four blended courses met face-to-face the first two weeks of the semester, and then face-to-face every two or three weeks for the remainder of the semester depending on the semester schedule. Courses typically met an average of five times on campus for two to three hours each meeting during the semester. Web-based materials (syllabus, course schedule, assignments, etc.) were made available on a course Web page hosted by the department. Face-to-face class meetings focused on high-priority skills or knowledge to ensure that students could complete upcoming assignments; this setting also allowed time for students to ask questions on assigned materials or skills they had questions about. An e-mail listserv was used to maintain discourse between class meetings.

Web-only LMS Courses

The four LMS Web-only courses used the campus' proprietary LMS, and all students and instructor interactions occurred within the Web-based system. Prior to the course initiation, the instructor provided course design and implementation within the LMS. No face-to-face or external e-mail was used with the courses. Course materials and discussion were provided only via the LMS.

Web-only LMS Courses Extended with the 3D OLE

The four LMS courses extended with a 3D OLE also used the LMS Web-only format; however, it was then enhanced by employing the 3D OLE to facilitate student-to-student and teacher-to-student interactions for the length of the semester. As with the traditional LMS course format, students would access the system, get course content, and post messages related to assignments and discussion. All Web-only communications utilized text-based tools such as e-mail, chat, and bulletin board postings. The 3D OLE was then implemented with the same schedule of face-to-face meetings as described in the blended courses above. Students were required to attend 30- to 60-minute online meetings the first 2 weeks of the course. The first two

sessions focused on answering students' questions, familiarizing students with the 3D software, and ensuring that students were prepared to complete assignment one. As with previous use of the system, students often spent the first session understanding the 3D OLE and exploring the instructional environment (Jones et al., 2005). Students could then login to the system to meet and talk (text or audio) about the course and assignments with their peers or the instructor. Optional online meetings with the instructor were also scheduled during the course, thus increasing contact hours. Optional meetings occurred between six to eight times during a semester. During optional meetings, the instructor would present additional materials to support current discussions and answer student questions.

Blended Courses Extended with the 3D OLE

The four blended courses extended with a 3D OLE used a combination of face-to-face, web-based instruction, e-mail, and a 3D OLE. Face-to-face classes were held during the first two weeks, followed by three additional optional face-to-face meetings later in the semester. Course materials were hosted on a department Web server. An e-mail listserv was used for daily text-based communications. Students could access the 3D environment at any time for additional discussions. Optional 3D OLE meetings occurred between six to eight times during a semester. The instructor would set a topic for each 3D OLE meeting, based on e-mail discussion, and present some notes on that topic before answering student questions.

DATA COLLECTION

Messages exchanged among participants in each course were collected in two ways. For LMS courses, all postings to the message system were saved at the end of the course. For courses using an e-mail list, the e-mail messages were saved during the course. All messages were then normalized. Normalization began with each message being broken into two parts. The first part was the header that contained date, time, and other information required to determine message flow. Header information not required for data analysis was discarded. The second part was the message content. In addition to messages, student grades from exams, projects, and overall course outcomes were examined.

DATA ANALYSIS

The strategy for this inquiry blends two research traditions. The first approach utilizes qualitative discourse analysis of message functions/speech acts and message flow, as outlined in Harris and Jones (1995, 1999) and Jones (2001). Using an inter-scorer agreement approach, each text-based message seen in a course is defined in terms of its category, function, and message flow.

The process of coding message function is based on the 22 descriptors (Table 2) formulated by Harris and Jones (1995). This procedure produces a more complete and in-depth rendering of message content since the scorers interpret the messages and functions collaboratively (Jones, 2001). It is based on past research that focused on conversational and spoken discourse analysis (Austin, 1962; Coulthard, 1977; Werth, 1981) together with research on non-real-time interactions (Black & Levin, 1983) as well as the analysis of e-mail interchanges based on naturalistic observation techniques (McCormick & McCormick, 1992; Rueda, 1992) that are similar to computer-mediated discourse analysis (CMDA) (Herring, 2004). Table 2 also indicates which descriptors were used to define rapport elements based on previous research (Christophel, 1990; Placencia, 2004; Yungbluth & Bertino, 1996).

The process of gaining agreement between peer-debriefers/scorers requires that they meet in person to review the codes assigned independent-

Table 2
Listing of Message Function

Rapport elements indicated by *
Reporting Information
Content Information
Procedural Information (content-related "how-to" information)
General Information
Directions (non-content-related "how-to" information)
Personal Information*
Ideas/Opinions/Emotions*
Resource (book, video, or other resource information)
Feedback (non-content-related suggestions, evaluations, etc.)
Requesting Information
Content
Procedural Information (content-related "how-to" information)
General Information
Directions (non-content-related "how-to" information)
Personal Information*
Ideas/Opinions/Emotions*
Resource (book, video, or other resource information)
Feedback (non-content-related suggestions, evaluations, etc.)
Other
Salutation (greetings and closings, not including signatures)*
Planning (project planning)
Thanking*
Complaining*
Apology*
Personal Discussions*

ly, and then follow that up with a collaborative review of those codes. One person orally states the descriptors present in the message then the other scorer either affirms each label or voices disagreement. If a disagreement is announced, the scorer in disagreement typically asked a question such as, "I don't see a report of content here – where do you see it?" The original scorer then provides his or her viewpoint and discussion would ensue, and eventually, closure on the item in disagreement would be reached. At the end of the process, the coders would develop 100% agreement on these codes. Past research has been conducted at both the sentence and message level, and the message level for the number of messages being examined ensures trustworthiness of the online texts interpreted (Jones, 1996; Jones & Amill, 1995).

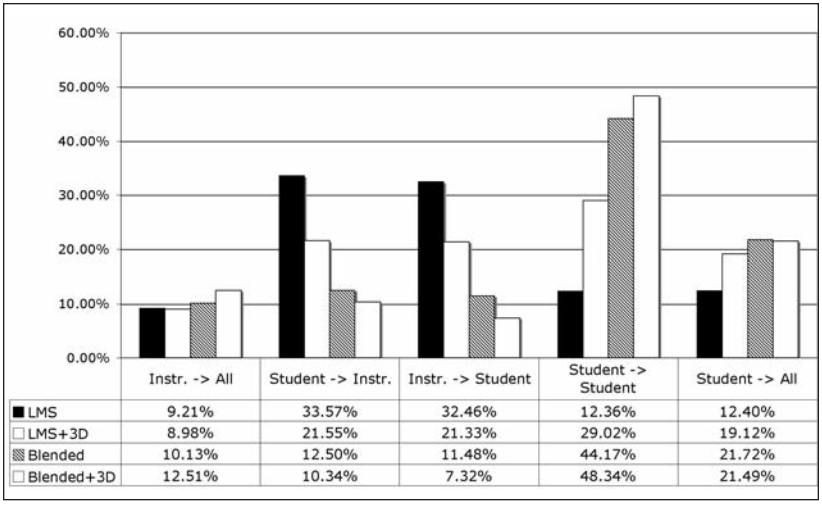
The second half of the inquiry takes the frequency of exchanges plotted to show activity. It compares the findings of the aforementioned discourse analysis to allow patterns to emerge from the exchanges in order to better understand the electronic discourse. One concern when analyzing courses in different semesters is the difference in holidays and student breaks. This issue was resolved by ensuring that the study had enough courses involved and that the participating courses occurred in different semesters, which reduced single semester anomalies in the frequency of exchanges. Also, since the same instructor taught each of the 16 courses, discussion formats remained consistent across all classes.

RESULTS

In order to accurately describe the results of the study, this section will begin with an explanation of the three primary figures used, a discussion of each and the results by method. The remainder of this section addresses the two primary course delivery methods, followed by the impact of the 3D online learning environment when extending those methods.

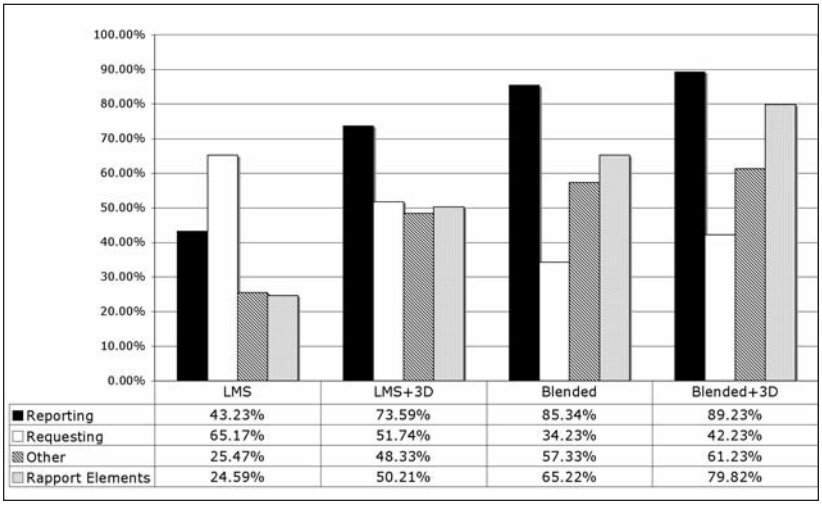
Figure 2 shows the averaged percentage of message flow type by method. Messages fell into one of five types. Instructor-to-all included announcement messages and student messages that were replied back to but addressed to all in the course. Student-to-instructor were messages directed to the instructor, like a request for information. Instructor-to-student were messages directed to the student. Student-to-student were messages between students. Student-to-all messages were those directed to students or to both students and the instructor. Analysis of the data will be presented below by method.

Figure 3 shows the frequency of message function class, averaged by the courses in each method. The figure shows reporting, requesting, and other along with the subset of rapport elements. These provided the main trends seen when averaged between courses in each method. It should be noted that a message can contain more than one function, so the percentage represents the number of times it appeared by the total number of messages in the method examined. Analysis of the data will be presented below by method.



	Instr. -> All	Student -> Instr.	Instr. -> Student	Student -> Student	Student -> All
LMS	9.21%	33.57%	32.46%	12.36%	12.40%
LMS+3D	8.98%	21.55%	21.33%	29.02%	19.12%
Blended	10.13%	12.50%	11.48%	44.17%	21.72%
Blended+3D	12.51%	10.34%	7.32%	48.34%	21.49%

Figure 2. Message Frequency by Flow Type per Method (Averaged).



	LMS	LMS+3D	Blended	Blended+3D
Reporting	43.23%	73.59%	85.34%	89.23%
Requesting	65.17%	51.74%	34.23%	42.23%
Other	25.47%	48.33%	57.33%	61.23%
Rapport Elements	24.59%	50.21%	65.22%	79.82%

Figure 3. Frequency of message function class (Reporting, Requesting, Other and Rapport) by Method (Averaged).

Figure 4 provides the average number of messages per student per week of the average courses over a 16-week period for each method. Assignments 1 through 4, Midterm, and Final Project periods are indicated in the vertical columns. The vertical columns span more than one week to reflect the vary-

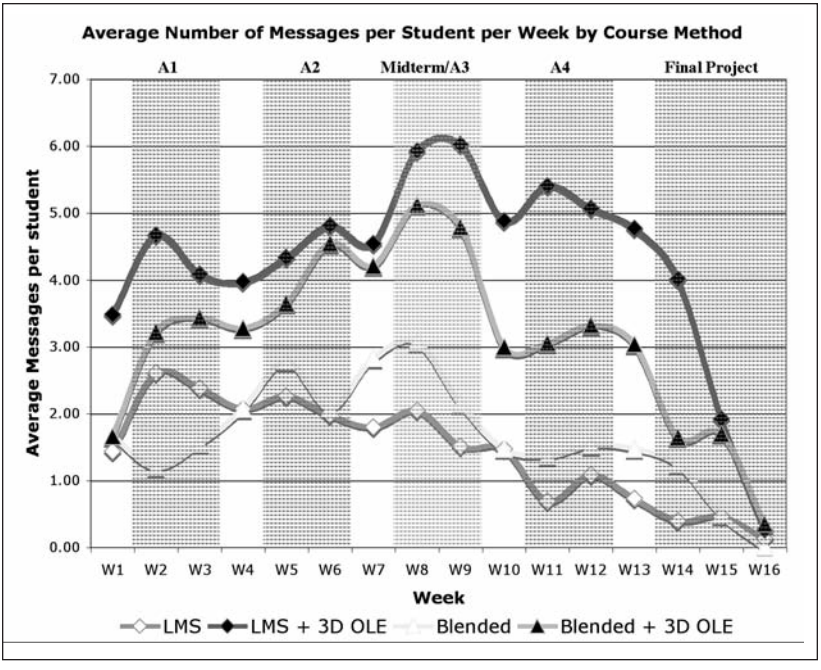


Figure 4. Averaged number of messages per student per week of the averaged courses for the Web-only and blended methods that were extended with the 3D online learning environment and overlays the previous course methods discussed.

ing deadline dates that occurred with courses that were taught in different semesters. Analysis of the data will be presented below by method.

WEB-ONLY LMS COURSES

The Web-only LMS course delivery method had the lowest average message exchange, at less than three per week, of any of the delivery methods (see Figure 4). This figure agrees with similar research of weekly discussion exchanges (Ackerman, 1998; Masters & Oberprieler, 2004). Students participated in the development of discourse early in the semester; unfortunately, these discussions slowed by the midterm examination and eventually dropped below one message per week for the latter half of the semester. It is of note that in weeks when discussion postings were due, more exchanges occurred because accompanying discourse analysis indicated that the majority of postings were only fulfilling the coursework requirements. The majority of the message flow was between the instructor and the individual stu-

dent for a total 66.03% of the messages. Students rarely created additional discourse to extend a topic, and any such extensions were generally a result of the instructor asking follow-up questions in order to stimulate interest in a topic. Once the instructor stopped participating, the students would not continue on with the discussion. Most of the student-to-student messages (12.36%) were discussions on course management and not content-related discourse. Exchanges in the courses showed the lowest number of rapport elements (24.59%) of any of the methods.

The majority of postings not specifically related to assignments were student-to-instructor information requests – messages to the instructor asking about assignment issues or to receive technical or other help. An important pattern that emerged was that students in the Web-only courses were less likely to complete discourse assignments towards the end of the semester. This finding relates to the fact that students would disengage from the required discourse once they had achieved the minimum number of postings that would result in the students' desired grades. In other words, as soon as the student determined that he or she would be receiving an acceptable overall grade for the course, his or her contribution to overall discourse significantly declined. Students who did poorly on the Midterm exam typically completed fewer discussions postings than those students who did well.

BLENDED COURSES

The blended courses met face-to-face during the first 2 weeks of the semester and utilized the Internet to extend the course discussion between the following three to four optional class meetings. Data indicates that online discourse did not accelerate until after the first two face-to-face class meetings, typically beginning in weeks three or four of the semester (Figure 4). The numbers of exchanges were similar at the start of the semester to the number in the Web-only courses; however, message exchanges were sustained longer into the semester (up until weeks eight and nine). Since the blended courses included face-to-face meetings, not all of the discussions took place online. The number of exchanges dropped off rapidly after the midterm; however, discourse increased again in weeks 11 through 13 as students discussed the Final Project and increased the student-to-student information requests and reports.

Discourse analysis revealed that the majority of the postings were follow-up discussions in which a student would send a message and students would then respond with information or help. Students initiated this form of discussion more often in this format than in the Web-only courses. The number of messages between students was on average three times greater than the Web-only courses. These messages were generally one student requesting help and then receiving multiple replies from fellow students on the request.

Upon examining message content, the students tended to utilize text-based communications tools to add depth to communications. For example, a student posts a question, another student then replies, followed by one or more students replying and extending the first student's content. The majority of messages not related to assignments were messages between students and these almost always included rapport elements (i.e. salutations, asking about events, etc). Rapport elements were found in over 65% of the messages, as compared to Web-only courses at 25% (see Figure 3). The majority of messages containing rapport elements were contained after weeks five and six. The blended courses had met at least three times in person at this point in the courses. Many of the assignment-related exchanges contained rapport elements starting in weeks five and six. These trends indicate that between the initial face-to-face meetings and e-mail messages, rapport was attained between weeks five to eight (halfway into the course). The important aspect here is that rapport was attained and can be seen in the exchanges when compared to the Web-only courses that showed little rapport building.

COURSES EXTENDED BY THE 3D ONLINE LEARNING ENVIRONMENT

Results of the data analysis indicate that the use of the 3D OLE helped improve discourse greatly with Web-only courses and slightly with blended courses (see Figure 4). Four key areas emerged that the 3D OLE helped:

1. early creation of discourse in the first few weeks of the semester;
2. higher levels of discourse during the semester,
3. sustained discourse throughout the semester, and;
4. more use of rapport descriptors in text-based exchanges.

Early Creation of Discourse

The additional time and interactions, about one hour each week for an average student online time between four and eight hours during the semester within the 3D OLE, resulted in several impacts on student discourse and interaction. The primary elements impacted were the amount of discourse, message flow, and message function. First, discourse accelerated such that the indicators show (see Figure 4) that it was firmly established by week two for both extended course methods as compared with the Web-only courses that never established such and both the independent and blended courses in which consistent discourse was entrenched midway through the course (5-7 weeks). Message exchange for both the extended Web-only and blended courses were more than doubled in some weeks and overall were greatly improved. By week five, average discourse for the remainder of the semester was between two and five times greater than the other approaches by them-

selves. Secondly, message flow was changed in both methods (see Figure 2) and showed improved discourse as will be discussed in the next section. Thirdly, the use of message function changed as a result of more discourse and changes in message flow, such that reporting functions increased for each method and requesting functions decreased for Web-only. The early creation of rapport by adding a slight number of additional contact hours and more importantly context by way of the 3D OLE positively impacted the early creation of student discourse that then impacted the level of discourse, sustained it through the semester, and heightened the use of rapport among participants.

Higher Levels of Discourse

Higher levels of discourse were seen by the change in message flow and message function found in courses extended by the 3D OLE. For Web-only, message flow changed such that student-to-student flow rose from 12.36% of exchanges to more than double at 29.02% (+16.66%) when using the 3D OLE. While the blended courses benefited, the benefit was less with only an increase of +4.17%. Exchanges between instructor and student (one-to-one communications) with Web-only went from a combined 66.03% down to 42.88% (-23.15%) when using the 3D OLE. The change for blended courses were again slight but reduced at -6.32%. A reduction of student and instructor flow and rise of student-to-student flow is a good indication of improved student discourse. Further examination of the message functions showed that most student-to-student message exchanges were content focused. Discourse did fluctuate during the semester. During weeks with assignments requiring the development of discourse, the same fluctuation of message exchanges was noticeable between all methods. However, the methods extended by the 3D OLE as discussed in the next section sustained for a longer amount of the semester.

Sustained Discourse throughout the Semester

Meaningful discourse exchanges in the 3D OLE extended courses were sustained until near the end of the semester as compared to Web-only that never were sustained and blended courses that were sustained for half of the semester. The students who used the 3D OLE maintained an average of at least three or more messages each from the midterm through the end of the semester. Overall, students in these extended courses conducted a greater number of exchanges over longer sustained periods. Discourse analysis indicated that the majority of messages in these courses were between students with an emphasis on helping one another, as reflected by information requesting (content, procedural, and resources) and information reporting (content, procedural, and directions), which were coded the most. The next largest message group involved students discussing course topics beyond the

minimum requirements of the assignment. As with the other two approaches (Web-only and blended), there was a drop in the amount of discourse shortly after midterm; however, the drop was not as significant as with the other approaches.

More Use of Rapport Elements

Rapport descriptors found in the discourse indicated higher instances of rapport elements in the courses using the 3D OLE compared to the Web-only or blended only courses. The number of rapport elements present in exchanges in these extended courses was improved such that Web-only more than doubled from 24.49% to 50.21% (+25.62%) and for blended increased by +14.60%. It is interesting to note that rapport elements used in exchanges increased with each method from 24.59% to 79.82%. This would support that fact that Web-only to Web-only+3D OLE to Blended to Blended+3D OLE provide different stages or a continuum of available rapport creation participants responded to, which was reflected in the use of rapport elements in the examined exchanges.

STUDENT SATISFACTION AND GRADES

Students, in semesters when the 3D OLE was used, were asked at the end of each semester to take an extended course evaluation beyond the university's standard evaluation. The evaluation asked questions specific to the use of the 3D OLE in the course. The question on satisfaction, a likert-like five point scale, asked the student how satisfied they were using the 3D OLE during the course and did they feel that it improved the course. When this number is compared to the number of sessions the student participated in during the semester, students who used the 3D OLE four or more times during the semester, which normally represented between three and four hours of total online interaction, had a higher positive perception of the use of the 3D OLE (see Figure 5). Students who used the system less often typically indicated less satisfaction with the use of the 3D OLE. These findings are congruent with previous research on the same 3D online learning system, reflecting significant outcomes for user satisfaction and overall attitudes towards the technology (Jones et al., 2005). No significant differences were found between grade outcomes in the courses examined in this study.

STUDY DISCUSSION

The findings of this study reflect patterns of accelerated exchanges and changes in discourse among students when using the CRG 3D OLE. When employed to extend communications in either the blended or Web-only approaches, this technology positively increased both the quantity and over-

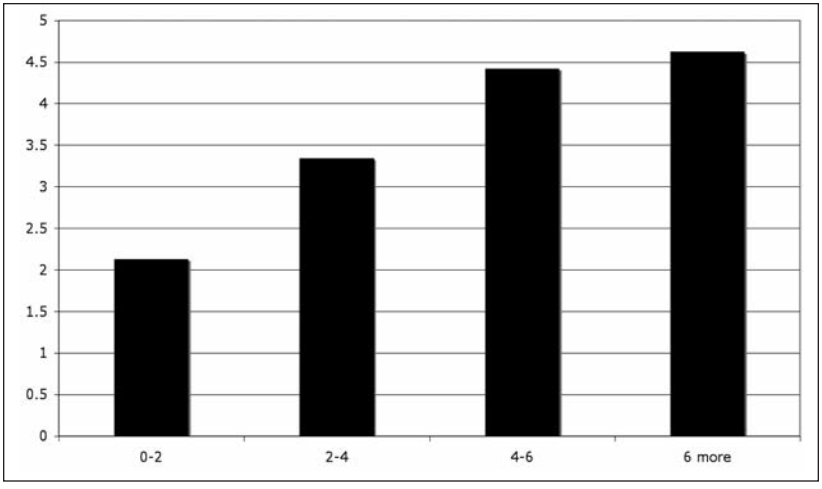


Figure 5. Averaged student satisfaction using 3D OLE during the extended courses by the number of online sessions.

all quality of discourse. From the learner-centered perspective, this is the result of student-initiated discussion that is ultimately more in-depth and focused. When comparing the type and frequency of discourse between course delivery methods, the key emergent element is the speed with which rapport generation occurs and reaches a critical mass of online discussion that is consequently self-sustaining. These findings suggest that for quality discourse to occur, the first five weeks of a semester course (10-16 weeks long) are the most critical time period for supporting student interaction that will result in rapport and strong student discourse. If the online learning community does not reach critical communicative mass within this time period, self-sustaining generation of rapport is more difficult and may never occur in that course.

Further, while blended course delivery helped develop rapport, the rapport was seen to help develop a community around this practice of learning that went beyond completing the base requirements of the course. The periodic face-to-face meetings encouraged denser communications at the outset that provided the sufficient interaction needed for a community of learners to establish rapport. By providing comfortable cognitive scaffolding through more traditional class meetings and interaction, these meetings ultimately resulted in accelerated discourse.

While the face-to-face component is meaningful, it is important to note that the data supports using the 3D OLE to generate rapport because it has comparable effects to face-to-face meetings while allowing learners to

remain at a physical distance, which is so important to distributed learning. We find support for the idea that 3D technology allows users to communicate in a more naturalistic sense comparable to face-to-face settings, which ultimately lessens the cognitive workload often associated with text-based solutions (Snowdon, 2004). We believe that this data supports Picciano's (2002) idea that other types of highly-interactive forms of online communications (i.e. video, teleconference, etc.) can be used to extend LMS or blended courses, and should produce similar results. However, the main benefit of employing 3D online learning environments is that they better address bandwidth considerations than other higher bandwidth-intensive delivery systems (Jones, 2004). This form of environment is scalable to most homes with Internet connectivity and a reasonably modern computing system.

We believe that these findings stem from the fact that the 3D OLE effectively simulates rapport-building aspects of blended courses resulting from its visually iterative nature. We mean by this that the cognitive scaffolding normally provided by the instructor or peers is repurposed as 3D learning objects that allow learners to easily connect physical symbols to meaningful concepts that can be used to do the work of learning. By extending beyond the current text-based paradigm via feedback mechanisms such as hand gestures, facial expressions similar to those experienced in real life, and other visual cues expressed by the digital avatars that represent the students, 3D online learning environments may better facilitate the generation of rapport in future studies. This is in keeping with findings from Baylor (2005) and Baylor and Kim (2005) related to human perception of digital avatars. Such generation should result in more frequent exchanges earlier in the semester, in turn fostering higher-order, quality discourse.

CONCLUSION

This research indicates that a 3D OLE being used to extend Web-only and blended courses can have a positive effect on the creation of effective discourse within learning communities. Web-based communications will continue to be a primary method of course delivery, and any new instructional technology will likely enhance existing systems, rather than replace them. Illustrating how a 3D OLE impacts an existing course delivery method without drastically reorganizing the overall course is fundamental to any future paradigm shift in favor of new multi-user, interactive online systems. The findings from this research offer such a basis, and by suggesting that a 3D system provides a bandwidth-efficient means of allowing students to interact in real-time via avatars, full-duplex audio, and other collaborative sessions, as well as tools to in turn generate constructive rapport, both the positive and practical aspects of implementing such technology become apparent.

As processing performance on low-cost personal computers increases,

these systems offer institutions the ability to provide unique online collaborative learning opportunities in the areas of language, science, computer graphics, and other fields (Chen, Toh, & Fauzy, 2004; Jones, 2003). Consider that the 3D OLE used in this study cost less than $5,000 to implement. This important detail illustrates that a relatively small investment can produce significant outcomes in improving overall student discourse. Therefore, with a small investment, schools utilizing Web-based course delivery methods can provide 3D online learning environments with little impact on their current course delivery structure. More importantly, they will have the flexibility to create innovative, successful online learning communities that meet the needs of students and teachers.

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