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Donald G. Perrin  
Executive Editor

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**Table of Contents – March 2006**

	Page
<b>Editorial:</b> Donald G. Perrin	1
<b><u>Invited Paper</u></b>	3
<b>Building the Academic EcoSystem: Implications of E-Learning</b> John Witherspoon	
<b><u>Refereed Papers</u></b>	
<b>Thread Theory: A Framework Applied to Content Analysis of Synchronous Computer Mediated Communication Data</b> Shufang Shi, Punya Mishra, Curtis J. Bonk, Sophia Tan, Yong Zhao	19
<b>Content Analysis of Online Transcripts: Measuring Quality of Interaction, Participation and Cognitive Engagement within CMC Groups by Cleaning of Transcripts</b> Peter K Oriogun	39
<b>Web-based Distance Learning Technology: The effects of instructor video on information recall and aesthetic ratings</b> Cristina Pomales-García and Yili Liu	55
<b>Connecting Distant Communities through Video Communication Technologies in Design Studio Workshops</b> Federico Casalegno and Larry Sass	71
<b>The Impact of an E-Learning Strategy on Pedagogical Aspects</b> Felix Mödritscher	85
<b>Conducting a Qualitative Research in Online Courses: Experiences of a Novice Researcher</b> Omur Akdemir	99



**Editorial**

**The Key to Survival**

**Donald G. Perrin**

Research is the key to survival. Fast changing technologies demonstrate this.

Do we really expect it to be different for disciplines that change very slowly? Let me give some examples from my own experience.

In the 1980s the Wang word processor was redesigned for use on a PC. It looked like a Windows based program ahead of its time. It was fast and easy to use and not demanding on hardware or memory. The originators had taken it to the limit of creativity and perfection. There was nothing more that could be added and research was no longer necessary. It died within 18 months. The reasons: Steve Jobs and the NEXT computer opened a new era of creativity, and Windows added many of these features for use on PCs.

The fourth largest PC Company in 1982 was Corona Computer, later renamed CoreData. I wrote their user manuals and technical documentation. It had a brilliant and prolific research team that created a product that eclipsed IBM and kept up with Compaq, the two leaders at that time. (I forget who was number 3.) The company was bought by a foreign investor who put all of the company's resources into production. Within 18 months the company ceased to exist.

There have been many statistics to show optimum levels for research budgets based on what leading companies spend, but that does not guarantee that another company can expect the same results if they spend the same amount of money. Goals, focus, creativity, timing, management are part of the equation. I remember visiting the fledgling Lotus Development Company when they moved into their expanded facility in 1982 – 180 people in all. I asked how many people were in the programming team and they pointed to one person. The genius factor does not fit into the mathematical equation; it supplants it.

Moving to a slowly evolving discipline like education, we need research investment and genius to meet the needs of today's students. E-Learning is the part of education that is evolving most rapidly. It is folding a century of research and development in communications, learning, and human behavior into a new discipline that is more observable and measurable than the verbal lecture or the traditional laboratory classroom *because* it is transmitted through media that are recordable and measurable. As a result, we have data to improve the organization and presentation of ideas, and we can combine expertise from multiple sources into teaching and learning products that we can continually improve. All we need is to have that spark of genius to lead us, and the willingness of politicians to stand out of the way so teachers and educators at all levels can do their jobs and be the very best at what they do.

This Journal, supported by hundreds of authors, dozens of reviewers, many of them the best in their respective disciplines, is an important vehicle for sharing research, stimulating growth and creativity, and identifying genius. We are also supported by a worldwide community of readers – learners, experts, and geniuses - approaching 50,000 worldwide. Thank you. The survival of learning is assured!



**Editor's Note:** This paper presents highlights of the Western Cooperative for Educational Telecommunications (WCET) November 2005 conference. Based on notes from the conference presentations, it summarizes the evolution of technology in 21st century education. It is republished with permission of the Western Cooperative for Educational Telecommunications and the author. Additional information can be found at <http://www.wcet.info/> and <http://www.wcet.info/resources/publications/>.

### Invited Paper

## Building the Academic EcoSystem: Implications of E-Learning

John Witherspoon

December 2005

*WCET ([www.wcet.info](http://www.wcet.info)) is a cooperative of two-and four-year institutions (for profit and not for profit), higher education agencies, and corporations from 45 states and nine countries. Founded in 1989, the Cooperative's mission is to advance the effective use of technology in higher education. Its annual conference, held in late fall, pulls together the field's leading thinkers and innovators to discuss the year's major happenings and most pressing issues, to explore key innovations and best practices, and to forecast the future.*

The subtitle of WCET'S 2005 Conference, held November 2-5 in San Francisco, was *Re-imagining the Academic Ecosystem* [1]. It soon became clear, however, that those attending are, step by step, actively designing and constructing that ecosystem. In reporting the state of e-learning in higher education they are also, in a real sense, mapping a major direction for postsecondary institutions, faculties, and students.

WCET members are engaging a rapidly evolving and diverse student population. They are seeking best uses of the technologies now available while they develop IT's next generations. They wrestle with institutional change and opportunities for fertile collaboration while they struggle with negative trends in funding. They are addressing change – cultural, technological, demographic, political, and financial – as they shape that academic ecosystem: tomorrow's environment for learning.

**Thus Spake Katrina.** The 2005 hurricane season, exemplified by Katrina's devastation of New Orleans – and moving WCET's conference to San Francisco -- produced both disaster and enterprise. The disaster is evident to the world: thousands homeless, questions of whether recovery is possible, and personal responses ranging from selfless gallantry to gunfire targeting rescue helicopters. Within higher education, many colleges and universities sustained damage, but some were able to offer help: shelter in dorms, communication assistance, logistical support.

But what of the students whose education had been – at least – interrupted? There was a virtually instant response, led by Bruce Chaloux and the Southern Regional Education Board (SREB) [2]. Working with the Sloan Foundation and Sloan Consortium [3], SREB initiated the Sloan Semester: online courses from many volunteering universities to enable students to stay on track during that demolished fall semester, looking toward rejoining their home institutions in the spring. It was characterized as “A bridge for students back to their home institutions.” The Sloan Foundation provided stipends to the host institutions (some declined to accept the funding). There was no charge to the students. To overcome the problem of student records during the emergency, all parties agreed to accept SREB's VESA, The Visiting Electronic Student Authorization [4], certifying that the student was qualified to take the course. SREB's initial canvass indicated 60 interested institutions; eventually 200 were involved. With the Sloan Semester to begin on October 10, there were a thousand online courses available by September 15, with more to come.

As the semester got underway there had been 1725 VESA applications processed for 4256 “seat” requests.

During the WCET session at which the Sloan Semester was described, Mike Abbiatti [5] presided. Mike, Associate Commissioner for Academic Affairs at the Louisiana Board of Regents, drew on the Louisiana experience to urge the development of a Higher Education Emergency Management Assistance Compact – a cooperative approach to dealing with emergencies. And he distributed a parable concluding that “We are all involved in this journey called life. We must keep an eye out for one another and be willing to make that extra effort to encourage one another. . . . Nobody makes the journey alone.”

***Describing the Ecosystem.*** That sense of commitment plus enterprise was a focus of the conference.

One early indicator of commitment and enterprise came from the hard-pressed WCET staff, who scrambled against significant odds to move the whole event to San Francisco when New Orleans was inundated. That feat involved everything from last-minute negotiations to logistics to programming, and the result received overwhelmingly positive reviews.

The final conference program covered the full spectrum of the emerging academic ecosystem, with the implications of it all for colleges and universities.

In these pages we’ll consolidate that diverse menu to three major sections: the student body; technology, teaching and learning; and the evolving institutions of higher education.

***The Academic Ecosystem I: The Students.*** Time was when undergraduates enrolled as freshmen at 18 and graduated at 21. The typical curriculum emphasized the liberal arts, leavened with a bit of science and math, administered via classroom lectures, textbooks, and the library.

Today we have the Net Generation[6], defined as those born between 1981 and 1995. At the San Francisco conference the California State University system reported a survey of 3000 students and 3000 faculty members over a three-year period. In shorthand, the Net Generation student is: Digital, Connected, Experiential, Immediate, and Social. Concerning exposure to media, this generation has: spent 10,000 hours with video games; sent or received 200,000 emails; spent 20,000 hours watching television and 10,000 hours on a cell phone; but less than 5000 hours reading.

These numbers are reinforced by a 2004 Student Monitor study [7] reported in the EDUCAUSE Pocket Guide to U.S. Higher Education. Full-time undergraduates in four-year colleges and universities spend an average of 15.1 hours per week on the Internet, up from 5.5 hours in 1997. Ninety percent access the web at least once a day.

These students are multi-taskers (at least electronically), want activities rather than lectures, and like teamwork. Unlike some previous generations, they tend to accept their parents’ values and guidance. They are happiest in groups. They want immediate feedback. They consider the faculty to be experts and assume that these experts should use technology effectively and efficiently.

Meanwhile, there’s also an increasingly diverse population of adult students whose goals are specific, targeted, and not necessarily degree-oriented. But these people have one big thing in common with the Net Generation: a recognition that higher education is a major key to success.

Seventy-five percent of today’s workforce believes they will need university-level education to advance – or even to retain their jobs. Of those between 18 and 29, 94 percent believe additional training or education is important for their success.

That belief was reinforced by Dennis Jones of the National Center for Higher Education Management Systems, in a conference presentation drawing on U.S. Census Bureau data [8]. The



graphs showed a strong correlation between educational attainment and personal income, plus a parallel link in the relationship between educational attainment and health.

Common to students at all levels is the assumption that information technology will be integral to the academic ecosystem. Part of the California State University survey revealed that in 2005, 87 percent of students accessed the campus network from off campus, 80 percent of them with a high-speed connection. The campus network was also used on-campus by 85 percent of students. A related point from several presentations: In the current evolution of education, technology is involved essentially without question.

Among the current changes is the student's relationship to a given "home" institution. People in the workforce are seeking institutions that can respond to a career need, and on-campus undergraduates are shopping for desired courses. As the WCET conference was underway, the Chronicle of Higher Education was reporting a study by the National Survey of Student Engagement [9], finding that "Almost half of college seniors took at least one class from another postsecondary institution before enrolling at their present institution. A third of seniors took at least one class at another college after enrolling at the institution from which they planned to earn their degree." (Chronicle of Higher Education, November 11, 2005, p. A37)

So today's student body is diverse in many ways. Traditional curricula are increasingly matched by an institution's programs – on campus or online -- for working adults and lifelong learners. Oregon State University reports that the average age of its online E-Campus students is 36. Sixty-five percent are female. Most are from Oregon, but the university's online students come from all 50 states and 12 foreign countries. From Minnesota's Twin Cities, Metropolitan State reports an enrollment of 9100 with a median age of 32. Two-thirds of these students are part-time and most work full- or part-time. Many are transfer students. More than one in four are people of color, including immigrants from Africa or Southeast Asia.

Programs are being broadened to reach underserved populations. California's West Hills Community College District has established a program for the area's farm workers and packing house laborers, many of whom speak little or no English and may not have learned to read and write their native Spanish. Through the Huron Technology Center [10] they can take a variety of courses or programs – in English or Spanish -- from a number of area locations, at no charge. The program is designed to offer needed individual basic courses, high school equivalency programs and, through local universities, eventual bachelor's degrees.

Washington State University's Distance Degree Programs recognize that the student's goal may not match a university's traditional assumptions. For example, a student may define success as enough education to get a job, perhaps to return when the future requires more. To engage such off-and-on students and encourage their study, research has demonstrated the virtues of helping them to engage -- building social networks, providing advising and program information, and helping develop study skills. Accordingly, WSU has added some social elements to the ecosystem:

- Football games and a group lunch
- A one-credit class face-to-face in Pullman, plus a social event
- Ten learning centers in the state providing advisers. Advisers invite students (current, prospective, and alumni) to the learning center. -Social networks including mentors; mentors are assigned to students who want them, before the semester begins. -Online chat rooms for students, mentors, and others -Virtual facilitators (students or alumni) to help develop academic skills

At Washington State University, as in peer institutions wherever they may be, the diversity inherent in today's institutional mission brings forth strategies and services attuned to the times.

Finally: The traditional, revered mission of the university is teaching, research, and service. The 2005 WCET Conference demonstrated that teaching and service are melding. Colleges and universities are reshaping themselves to address the full spectrum of individual, societal, and workplace issues and requirements. But as ever, the academic ecosystem begins with students – all of them.

***The Academic Ecosystem II: Teaching, Learning, and Technology.*** The closing session of the 2005 conference raised the biggest questions. Chaired by David Lassner, University of Hawaii CIO, the speakers were David Wiley of Utah State University and Marc Prensky of games2train. Some key points included:

- -Do classrooms make sense at all? And
- -We don't teach; we set up conditions for learning.

The speakers particularly cited the thoughts of George Siemens concerning the learning theory of Connectivism, referring to quotes such as the following from the Siemens blog [11]:

*Administrators, learning designers, and teachers are facing a new kind of learner - someone who has control over the learning tools and processes. When educators fail to provide for the needs of learners (i.e. design learning in an LMS only), learners are able to "go underground" to have their learning needs met.*

*This happened in a program I was recently involved in as a learner. An LMS was the main learning tool (which was a good choice for the program - many of the learners valued the centralized nature of communication and content presentation). After a short period of time, however, groups of learners "broke off" from the program and started holding discussions through Skype, IM, wikis, and other tools. Learners selected tools that were more tightly linked to the types of learning tasks occurring. When the learning was content consumption or simple discussion threads, the LMS was fine. As the learning became more social, learners started using tools with additional functionality. The learning required by the instructors – assignments, discussions – still happened in the LMS. But much more meaningful, personal, and relevant learning happened underground – outside of the course.*

*This was a great example of the foraging dimension of learning - we keep looking until we find tools, content, and processes which assist us in solving problems. Our natural capacity for learning is tremendous. We overcome many obstacles and restrictions to achieve our goals. It's also an example of the short-sighted nature of some learning programs. The problem rests largely in the view that learning is a managed process, not a fostered process. When learning is seen as managed, an LMS is the logical tool. When learning is seen as a function of an ecology, diverse options and opportunities are required.*

However one views higher education's technology evolution, there's a major transition underway in functions of a student. Peter Pizzor described the elements of the transition as: precise mass customization; higher levels of engagement; and a profound reframing from an instructor focus to a student focus.

We might observe that while there was not a session devoted to the iPod, the ghost of Mr. Jobs's creation was everywhere – certainly in the evolving relationship between instructor and student.

In addition to changing the nature of teaching and learning, the development of online material introduces the prospect of sharing resources, whether through such offerings as the Open

Courseware program of MIT and others, mechanisms such as MERLOT, commercial developers, or sets of cooperating institutions.

Key questions in such arrangements, however, include “What constitutes good practice?” “How can we evaluate courses effectively?” “When students use this material, does it work? Do they learn what the faculty and designers intended?” The WCET conference included presentations about major programs that address these issues. They included EduTools, a project of WCET [12]; the Online Course Evaluation Project of the Monterey Institute for Technology and Education [13]; and the International Benchmarking Project of The Observatory on Borderless Higher Education and WCET [14].

While these are distinct programs, they certainly cooperate. EduTools provides independent reviews of e-learning materials, side-by-side comparisons of products, and consulting services to assist decisionmaking. Conference participants learned of a current EduTools program to evaluate online Advanced Placement courses. It was developed in association with the Western Consortium for Advanced Learning Opportunities (WCALO) [15], WCET, and the Monterey Institute’s Online Course Evaluation Project (OCEP). The session “A Systems Approach to Online Course Evaluation” described the process of identifying course developers, applying agreed selection criteria, describing a course using OCEP procedures, and finally making successful course material available via the National Repository of Online Courses (NROC) library.

In the International Benchmarking Project WCET is working with the multi-nation Observatory on Borderless Higher Education, using established processes of the Association of Commonwealth Universities. The approach is both formative and evaluative. Participating institutions go through a structured self-analysis, followed by a review by external assessors, the development of statements of good practice, a 3-day workshop involving institutional leadership, and a final report. The evaluation considers statements of good practice, ranking institutions on such points as:

*The role of e-Learning in supporting the institution’s mission is included in key strategic documents. The expected goals and outcomes of technology use (i.e., increase access, increase quality, control costs) are clearly stated and understood. And e-Learning is one of the responsibilities of the chief academic officer. It is not a technical issue.*

Throughout higher education’s ongoing methodological evolution the issue of quality is a constant. There was consensus among the speakers in a conference session on quality assurance that quality is developed not by one faculty member acting independently, but by standardizing the course outline and general approach by the institution; that is, by the faculty as a whole, with expertise in course content, learning theory, and the range of elements that are involved in creating a course. This approach is hardly traditional, but perhaps the home institutions of these panelists provide examples: they represented Capella University, the University of Phoenix, and the University of Maryland University College (UMUC).

While technology applications often focus on course development, assessment, and availability, other issues and opportunities also receive attention. One of the conference’s caucus sessions touched on the implications of increased connectivity, linking institutions within systems, states, or regions. In addition to course-related issues, there arise questions concerning credit transfers and student records, adoption of common or compatible technologies, and many more.

Student services has become one of the most promising areas for the effective application of information technologies. A major example: conference participants learned about a promising, research-based development. The Center for Transforming Student Services (CENTSS) [16] is a

partnership among WCET, the Minnesota State Colleges and Universities, and Minneapolis-based Seward, Inc., a developer of ROI-based strategies related to e-Learning.

CENTSS is developing a national resource on best practices in online student services programs. Based on research regarding 20 student services, those developing the Center focused on the undergraduate student's perspective: What works? What really helps? Assessment of an institution's online student services includes a web-based audit tool, developed from research identifying the critical components of each service and examining them at increased levels of sophistication. The audit may be a self-assessment using the audit tool or an outside independent audit conducted by CENTSS.

The Center also provides best practice profiles about online students services, a range of publications and presentations, consulting services, and webcasts and workshops.

Throughout the discussions of a technology's potential, its quality of service, and the spectrum of possible applications, there arises, properly and inevitably, the issue of cost. Conference participants got an update on WCET's Technology Costing Methodology (TCM) [17], which permits institutions to compare possibilities and make reliable estimates of the costs of alternatives. Funded by the U.S. Department of Education's Fund for the Improvement of Postsecondary Education, WCET has produced a set of tools enabling an objective look at that ever-present elephant in the room: cost.

In summary: there is no longer a question of whether a college or university will make information technology an important part of its future. Instead, the questions are How best to apply these technologies? For what services? Under what administrative structures? How to achieve maximum benefit? For whom? With what tradeoffs? At what cost? Such questions are shaping tomorrow's academic ecosystem.

***The Academic Ecosystem III: Institutions and Issues.*** It's a truism that colleges and universities face trying times. While maintaining their historic mission to educate students broadly -- reinforcing the foundations of a civil society -- they are crucial to development of a diverse, qualified (and, one hopes, prosperous) workforce. Student demographics have changed dramatically: commonly, only one in five college students fit the traditional image of an 18-22 year old living on campus and attending fulltime. Outreach and access are increasingly important. Technology is changing everything from pedagogy to system-wide decision-making. There is an ever-stronger emphasis on quality and accountability. Meanwhile, funding, particularly from state and federal appropriations, seems on a path from problematic to dismal.

The key issue of access and outreach has been addressed in some detail by the Southern Regional Education Board (SREB) in an action agenda for states, colleges and universities, and the region. The plan, distributed to those attending the 2005 conference, was designed for southern college and university and state leaders, with help from SREB, to work toward four priority areas as they apply technology to extend access to higher education. The plan's ideas, however, are applicable far beyond SREB territory:

- *Extend citizen and student access in infrastructure, programs, services and training.* To achieve that priority: Expand access to high-speed Internet service for homes, libraries, and community organizations, especially in rural areas. Support the need for increased training and assistance for faculty and a higher level of service for students. Increase available financial aid for part-time distance learning students and working adults. Focus programs on areas with critical personnel shortages.
- *Take advantage of regional resources that can be shared.* To achieve that priority: Adopt an electronic tuition rate policy that allows colleges and universities to set prices for distance learning that are the same for all students, regardless of where they live. Develop

- agreements that make it easier for students to transfer their courses from institution to institution. Designate certain colleges and universities as “degree completer” institutions, where students’ credentials from various education providers will be certified, motivating students to complete degrees. Develop and improve joint academic programs delivered by distance learning.
- *Use state and institutional financing policies to more effectively support distance learning.* To achieve that priority: States create start-up loans for new distance-learning programs. Include major technology infrastructure and equipment purchases in capital budgets, thus easing swings in budgets for operations. Provide centralized funding for support services. Take advantage of joint purchasing cooperatives. Focus resources on areas likely to produce significant cost savings, either for the student or the institution. Focus special technology investments on projects that accomplish important statewide goals.
  - *Provide more and better information for quality improvement and accountability.* To achieve that priority: Provide better information about transferability of courses; articulation agreements should support easy transfer. Establish course ratings and evaluations to which prospective students have ready access. Ensure that data are collected and can be compared with data from other states. Use effective evaluation procedures to measure results. Use costing methodology models to better understand costs and assess distance learning’s “value added.”

The issue of collaboration – clearly crucial to the SREB plan – was echoed in numerous WCET sessions. At one, the speakers noted that in the University of Texas System Telecampus, like the programs described by representatives of Washington State University and Maryland Online, individual campuses provide courses while the system provides support services. At the UT Telecampus, for example, degrees may be based on courses from multiple campuses; some campuses don’t offer a degree in a given area but may offer courses pertinent to the degree offered elsewhere.

Collaboration is a critical component internationally. The Commonwealth of Learning (COL) [18] involves 53 countries, in which there are 22 open universities (many with enrollments over 100,000). There’s an emphasis on technology for distance learning, with media chosen to suit the situation. India has a dedicated satellite, shared with Africa, but Sierra Leone, with limited electronic access, emphasizes print. Several countries use radio. Asha Kanwar, representing COL, noted that not all collaborative efforts begin with western assumptions: Many small countries, especially in Africa, are seeking to invent themselves and choose not to use western institutions or models.

Sharing the session with Asha Kanwar was Svava Bjarnason, representing The Observatory on Borderless Higher Education (noted previously) and the Association of Commonwealth Universities (ACU). She reported that higher education is now on the agenda of the Commission for Africa, a G-8 initiative encouraged by Prime Minister Tony Blair. Of particular interest is the open university – open source movement [19].

A key component of inter-institutional cooperation is the trend toward accelerating connectivity. Mike Petersen of the Utah Education Network observed that in the Utah network traffic doubles every 18 months to two years, raising its own set of administrative issues.

Meanwhile, a set of regulatory and funding issues are upon us. One historic part of U.S. telecommunication regulation provides for the Universal Service Fund, originally intended to make telephone service feasible in rural areas. What is its future in an increasingly market-based industry? And what about the increasingly important issue of making the Internet as well as basic

phone service available to these hard-to-serve areas? The E-rate regulations were established to help provide telecom service to K-12 schools and public libraries. Will such subsidies be eliminated? If they remain, will higher education be included? (Higher education originally opposed the E-rate idea.)

CALEA (the Communications Assistance for Law Enforcement Act) was originally intended to require technical support for telephone wiretaps when legally authorized. Now there is a prospect that CALEA will be broadened to include Internet ISPs and institutions including colleges and universities, creating a long list of technical and legal issues.

The changes within institutions – and the forces bringing them about – have personnel implications as well. There is a major and continuing shift in the ratio between adjunct and fulltime (potentially tenured) faculty members. With the demand for well-qualified adjuncts rising dramatically, WCET launched AdjunctMatch, an online service that makes it possible for institutions to search a database of over 25,000 candidates, applying specific qualification criteria, to locate the adjuncts they need.

But of course all of the preceding involves the increasingly difficult problem of funding. State appropriations are dwindling, philanthropy is often problematic, federal support has its own targets and hurdles, and there is widespread alarm that rising tuition rates will be detrimental both to students and to the core mission of public higher education.

A preconference workshop was designed to help attendees address part of that problem. It was essentially a short course in grantsmanship, conducted by three veterans of the funding wars. They covered such issues as sources of support and the sources' priorities, effective development of proposals, evaluation issues, budget development, and the top 10 reasons for rejection.

Critically related issues were addressed in a major general session, "What Does Higher Education Reauthorization Mean for the E-Learning Community?" Chaired by David Longanecker, Executive Director of the Western Interstate Commission on Higher Education (WICHE), the session's speakers were Sally Stroup, Assistant Secretary, Office of Postsecondary Education, U.S. Department of Education; Steven Crow, Executive Director of the Higher Learning Commission; and George Mehaffy, Vice President of the American Association of State Colleges and Universities (AASCU).

Sally Stroup noted that the reauthorization was taking time but would be completed. She described the Distance Education Demonstration Project as small but doing well. That project authorizes selected institutions to demonstrate distance learning elements beyond the statutory boundaries imposed on the community as a whole. Ongoing problems involve student aid, definitions of campus and distance operations, and the difficulty of measuring outcomes.

Discussing the forthcoming Commission on the Future of Higher Education [20], she described its key challenges as "Where is change necessary?" and "What is the appropriate federal government impact – where is it needed?" She acknowledged that accrediting bodies are important, but observed that many people need to be convinced concerning quality in distance education. A key point: how do we know that the person who took the test is the same person who registered for the course?

Steve Crow listed as the accreditors' issues:

- How to evaluate learning
- What must be widely disclosed (a historically sensitive issue in accreditors' evaluations)?
- Issues concerning transfer of credit
- Roles of distance education, with associated difficulties

He noted that in considering the new commission's agenda, accreditors agreed to support the matter of establishing student authenticity as part of a compromise on other issues.

George Mehaffy led his remarks with a key comment on funding and higher education's cost to students: We are going to balance the books in this country on the backs of students. Too many can't afford college, and the rest are building too much debt. And he said that we need to do better with student records; at present we can't track records from several institutions over time.

The Mehaffy evaluation of the Commission on the Future of Higher Education was that it's a good idea, but limited. The important issue overall is accountability: What to account for? To what institutional mission? Establishing student success by what measure?

For colleges and universities, then, the higher education reauthorization discussion is one more indicator: it is indeed a new millennium. Many of the issues, agonies, and opportunities described at this year's WCET conference would not have appeared on the radar screen when many of today's academic leaders began their careers. The ecosystem is a-changing.

***So in Conclusion . . .*** At the 17<sup>th</sup> Annual WCET Conference builders of the emerging academic ecosystem met to report accomplishments and symptoms, raise difficult questions, and attempt some answers.

Hurricane Katrina wrought almost inconceivable damage but also spawned such creative responses as the Sloan Semester for displaced students. Technologies and the Net Generation of students produce such questions as whether classrooms still make sense, as pedagogy moves toward customization, higher levels of student engagement, and from an instructor focus to a student focus. One speaker suggested, "We don't teach. We set up conditions for learning."

Opportunities for learning are increasingly available as institutional networks and the Internet make higher education feasible for more people and make institutional collaboration both possible and economically desirable. Colleges and universities continue to create ways to reach new, previously inaccessible students and help them succeed.

Creative applications of technology have affected much more than courseware. Student services become increasingly personal; eventually they'll be customized for student interaction. Administrative networks facilitate everything from credit transfers and student records to financial aid.

Issues of good practice, accountability, evaluation and assessment, always on the table, have become more urgent. What will the Commission on the Future of Higher Education propose? And over all is the specter of funding, with public support generally shrinking, costs rising inexorably, and students – able or not – bearing more of the burden.

***Finally, then . . .*** The academic ecosystem is complex and ever-changing. With every new year both the mission and the clientele of higher education become more inclusive, more diverse, and more important for our nation's future. And as higher education responds, the effective use of technology is critical to its success.

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**Table 1**  
**Presenters and Presentations at the WCET 17th Annual Conference.**

Searching for Funds: How to Land the Big Bucks  
Brian Lekander, Sue Maes.

Designing the Future: Courses & Programs for Online Learners  
Gary Brown, Theron Desrosier.

Catching the Wave: Strategies for Expanding the Role of e-Learning in Workforce and Economic Development  
Michael Abbiatti , Bruce Chaloux, Dennis Jones.

Responding to a Major Disaster: Lessons Learned from Hurricanes Katrina and Rita  
Michael Abbiatti, Bruce Chaloux, Kathleen Gay, Will Monroe.

Roundtable - Open Source: Is It the Learning Management System You Wanted?  
Sylvia Currie , Dennis Hood, Scott Leslie, Roy Ramsey

Beyond E-Ilusions: Opportunities and Challenges for E-Learning in Global Markets  
Stephen Guild, Richard Hezel, Josh Mitchell.

Distance Learning - Where Does It Fit?  
Marie Cini, Curt Madison, James Monaghan

Quality Assurance in Distance Education: Who Sets the Standards  
Nicholas Allen, Michael Offerman, Craig Swenson.

Introducing the Center for Transforming Student Services  
Darlene Burnett, Vicky Frank, Patricia Shea.

Showcase - Bring the Fun Back into Your Lessons: Engaging Students with Multimedia  
Ean Harker, Kenneth Janz, Flora McMartin, Ellen Wagner, Svava Bjarnason.

Roundtable - Integrating E-Learning & IT into Campus Operations: Benchmarking the Progress  
Sally Johnstone

Full-Service or Self-Service? What's the Best Approach for Course Development?  
Mary Jane Clerkin, Charlotte Dowd, Carol Gering, James Monaghan.

A Dialogue with Regional Accreditors  
Steven Crow, Sandra Elman.

Comprehensive Student Service Models for Online Learners  
Kay Bell, Carol Lacey, Gayle Logue.

Planning for E-Learning Success: A Business Approach  
Mark Brodsky, Patricia Lipetzky, Warren Sandmann.

Showcase - Artificial Intelligence and Leading-Edge Technology  
Paul Brown, Kay McLennan, Beverly Woolf.

Roundtable - Critical Higher Ed Issues for the Upcoming Telecomm Act  
David Lassner, Mollie McGill, Steve Smith.

Slipstreaming: Leveraging Digital Resources  
Gerard Hanley

Service-Learning and Internship Opportunities: Enriching the Distance-Learning Experience while Reaching Out to the Local Community  
Leslie Costello, Barry Dahl, Darcy Hardy.

Universities Creating Public Tools for High School Students' Success  
Charles Masten.

Price, Funding, and Cost: Different Markets, Different Models?  
Nancy Parker

Showcase - Bridging K-12 to Higher Education  
Linda Braddy, Thomas Luba.

Roundtable - E-Portfolio Triumphs: A Value-Added Service  
Diane Goldsmith, Bruce Landon, Kathleen Willbanks.

Unprecedented Partnership to Boost Adult Literacy  
Douglas Glynn, Wesley Lawton, Elise Lowe-Vaughn, Susan Lythgoe.

Engaging Students in Large Online Classes  
Sallie Johnson, Sheryl Martin-Schultz.

Expanding E-Learning Activities in Canada and Mexico  
Dominique Abrioux, Patricio Lopez.

The Art of Playing Well Together  
Connie Broughton, Wendy Gilbert, Susan Smith.

Showcase - Closing the Opportunity Gap through Curricular Flexibility and Technological Synergy  
Bill Pepicello, Jason Scorza.

Roundtable - Addressing Quality and Retention Issues  
Janet Kendall, Muriel Oaks.

Inter-Institutional Partnerships and Intra-Institutional Politics: A Practical Guide  
Dawn Anderson, Paula Mochida, Donna Schaad.

Digital Learning Objects Repositories: Picking a Winner in the Software Derby  
Scott Leslie, Phil Moss, Frank Prochaska.

How to Cheat Online  
John Krutsch, Mark Sunderman.

Finding the Right Software and Migrating!  
Amber Dailey, Richard Fasse.

Showcase - Workforce Development  
Barbara Hoskins, Gerald Rhead.

Dumb is Smart: Learning from Our Worst Practices  
Myk Garn, Ed Klonoski.

Roundtable - Multimedia, Myth or Magic  
Linda Passamaneck, John Ruttner.

Videoconferencing Technology is better than Ever!  
Ritchie Boyd, Janis Hall, Tim McGee.

The Next-Generation Organization: Strategic Planning for Smart Change  
Linda Baer, Ann Hill-Duin, Donald Norris.

Competencies and Online - Do They Work Together?  
Stacey Ludwig, Phyllis Okrepkie.

A Systems Approach to Online Course Evaluation  
Lisa Cheney-Steen, Bob Threlkeld, Diane Threlkeld

Showcase - Is There Life (Oops)...a Living Wage after College? Career Tools and Research  
Cynthia Grua, Jean Mandernach, Ann Motayar.

AdjunctMatch: Your One-Stop for New E-Learning Instructors  
Joseph Pensa, Lenore Simonson.

Roundtable - International 101  
Svava Bjarnason, Asha Kanwar.

Evaluating E-Learning in Louisiana: An Institutional and Statewide Model  
Michael Abbiatti, Bruce Chaloux, Rhonda Epper.

Distance Learning: Dollars, Cents, and Benefits  
Terri Gaffney, Katrina Meyer, Emilio Ramos, Barry Willis.

What the Research Tells Us: Three Studies of Online Students  
Ed Hight, Herbert Muse, Thomas Peterman.

WOW Now: Lessons from the Recipients of the 2005 WCET Outstanding Work (WOW) Award  
Kay Kane.

Showcase - Teaching and Learning in a Digital Age: What Do Students Know and How Can They Help Each Other?  
Anita All, Cheryl Bowles, Joeann Humbert, G. Andrew Page.

What Does Higher Education Re-Authorization Mean for the E-Learning Community?  
Steven Crow, .George Mehaffy, Sally Stroup.

Roundtable - How Do Foundations Decide What to Fund?  
Catherine Casserly, Dewayne Matthews.

Instructional Design Support Strategies for E-Learning  
Susie Feero, Sidne Tate.

Serving Rural Learners  
Tricia Donovan, Chris Lott, Maggi Murdock.

The Net Generation: Facts and E-Llusions  
Patricia Cuocco, Steve Daigle, Gordon Smith.

Unbundling: Shifting Faculty Roles, Work-Load, and Scalability  
Dennis Bromley, Peter Pizor.

Showcase - Electronic Bouillabaisse: A Variety of New Applications and Tools Explored and Exploited in Distance Education and Technology Settings  
Paul Marquard, Rick McDonald, Dana Owens.

Roundtable - The Impossible Degree  
Farah Chase-Dunn David Litchford

Advanced Research and Education Networks: Global Collaborations  
David Lassner, Steve Smith.

Academic Efficiencies: Using Technology to Promote Collaboration  
Jo Lynn Autry Digranes, Chuck Cooper, Amy Smith

Does Quality Suffer when Adjuncts and Consultants Design Courses? Continuing Concern for Faculty Development  
Stephen Guild, Marty Hill

If Content Is King, Why Student Services Are the Heir to the Throne  
Paul Wasko.

Showcase - Supporting Instruction across the Curriculum One Student at a Time: E-Tutoring and Distance Library Services for Ensuring Student Success  
Lea Briggs-Simon, Christa Ehmann Powers, Tim Tirrell.

The Future is Now (And It's Even Coming Slowly to Education!): Strategies for Reaching Today's Students  
Marc Prensky, David Wiley.

## About the Author



**John P. Witherspoon**

**John P. Witherspoon** is a Senior Advisor, WCET Cooperative Consulting, and Professor Emeritus of Communication, San Diego State University.

He was founding General Manager of KPBS-TV/FM, the public broadcasting stations in San Diego; founding Chair of the Board of Directors, National Public Radio; the first principal executive for television of the Corporation for Public Broadcasting; President of the Public Service Satellite Consortium; and has served as a consultant to numerous universities and nonprofit organizations concerning educational and public service applications of information technologies.



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**Editor's Note:** Transcripts of online group discussions are subjected to content analysis to determine how learning occurs. The data is used to determine how learning occurs and how best to plan and guide these discussions. A Thread Theory is developed to simplify analysis of interaction, learning and teaching; pull disjointed threads together; and blend in new variables as needed.

## **Thread Theory: A Framework Applied to Content Analysis of Synchronous Computer Mediated Communication Data**

**Shufang Shi, Punya Mishra, Curtis J. Bonk, Sophia Tan, Yong Zhao**

### **Abstract**

Many different frameworks have been proposed for the analysis of Computer Mediated Communication (CMC) transcripts. There remains controversy regarding the appropriate methodology to better understand and represent interaction patterns and learning processes related to online group discussion. This paper points toward crucial aspects of online discourse, particularly those important for the purposes of learning and teaching. To this end, we took a grounded theory approach to develop the first draft of a framework we label as “thread theory.” Thread theory is used here for the discourse analysis of CMC transcripts based on the close analysis of a synchronous CMC transcript. Our analysis attempts to decode relationships between individual thinking processes and group interactions in synchronous computer mediated communication (CMC). This analysis also provides an evaluative model to qualitatively *and* quantitatively analyze the effectiveness of CMC. We believe that thread theory offers the first step of a new analytic technique that allows better understanding of the desired learning processes and learning outcomes mediated by synchronous CMC. We also offer suggestions for further research in this area.

**Keywords:** Thread, thread theory, framework, computer mediated communication (CMC), synchronous CMC,s transcripts, interaction patterns, learning process, online discourse, online discussion, research methodology.

### **Background and Rationale**

Synchronous computer mediated communication (CMC) is receiving increased attention in online education, while, at the same time, social constructivist learning theory has begun to dominate the educational literature across forms of delivery - face-to-face, blended, and fully online environments (Bonk & Cunningham, 1998). Social constructivist learning theory views knowledge as constructed by people in a context based upon the interpretation of experience and previous knowledge (Brunner 1960; Vygotsky 1978). “Highlighting the social nature of knowledge, social constructivism contends that knowledge is constructed through social interaction and collaboration with others—generated, established, and maintained by a community of knowledge peers” (Bruffee 1993, in McDonald, 1998, p. 8). It has been argued that CMC is a powerful social constructivist learning tool because of its capability to support interaction and collaboration among diverse and dispersed students (Jonassen, 1992; Jonassen, Davidson, Collins, Campbell, & Haag, 1995). According for McDonald (1997, p. 10), “Computer conferencing provides the two-way communication necessary for intellectually constructive interactions.”

The efficacy of CMC in a learning situation has been attributed to factors inherent in the technology as well as the nature of group functioning in a virtual environment. It has been argued that, in synchronous CMC, where exchanges are exclusively textual, the decrease in social pressures which results from the physical absence of people, encourages a greater freedom of expression and more spontaneity (Henri & Rigault, 1996). While always dependent on the surrounding conditions, synchronous CMC can stimulate a productive and interactive dynamic which gives rise to joint problem solving or a semblance of collective intelligence (Bonk, Wisher, & Nigrelli, 2004; Henri & Rigault, 1996).

Given the newness of this fast-emerging field, there is still a lot we do not know about the conditions under which synchronous CMC can serve pedagogy. A great deal of the emphasis in previous research has been on the design, development, and delivery-at-a-distance of self-study materials rather than about the nature and dynamics of virtual group discussion per se (Bonk & Wisher, 2000; Orvis, Wisher, Bonk, & Olson, 2002). Though research findings confirm the efficiency of CMC in terms of both social and cognitive development of learning (e.g., Henri, 1992), the means whereby educators, as well as learners, can use this efficiency to support learning is still an area that has not received a great deal of research attention. For instance, we do not yet possess a body of knowledge concerning factors related to the pedagogical characteristics of the content of computer conferences, the scenarios of how learning occurs, the elements that give rise to learning, and the complex web of relationship between these factors (Henri, 1992; Newman, Johnson, Webb, & Cochrane, 1997; Newman, Johnson, Cochrane, & Webb, 1996).

One of the most significant gaps in the knowledge base on the use of CMC for learning concerns the relationships between individual thinking and cognition and group interactions leading to joint cognitions. Of course, this is not an issue of CMC alone. For instance, while discussing discourse in “regular” classrooms, Cazden (1983) argued that those attempting to document the relationship between individual cognition or silent thinking processes and more noisy group processing face a complex and difficult journey. Cazden (2001) further claimed that this relationship between individual cognition and group interaction lies at the heart of student learning. In fact, understanding this relationship is essential for realizing the social-constructivistic potentials of CMC. Of particular significance to CMC researchers is the fact that, unlike a traditional classroom teacher, an instructor in a CMC setting does not have access to a range of modalities (e.g., inflection, gesture, facial expression, etc.) to base her interpretation of student learning. Typically, a CMC instructor must rely solely on the text messages sent by her students. Thus, it becomes vital to develop frameworks and methodologies that allow for the interpretation of synchronous CMC transcripts and infer how individual thinking has been affected by group interaction and negotiation.

The following section offers a brief literature review of different approaches to CMC research with a focus on transcript analysis. We also address some of the limitations and problems in the prevailing research methodology. For instance, we attempt to address the problems in these existing methodologies by developing a conceptual framework, namely, thread theory. Thread theory is based on the fine-grained analysis of a synchronous CMC transcript. We offer a detailed description of the process of theory development along with description of the theory. Finally, we provide an overview of the strengths and limitations of this approach and offer suggestions for further research.

## **Research Methodology in CMC**

A range of methods have been developed for the analysis of synchronous and asynchronous CMC. These methods include survey research, either through electronic or conventionally distributed questionnaires (see, for example, Grabowski, Suciati, & Pusch, 1990; Phillips & Pease, 1987; Ryan, 1992; Witmer, Colman, & Katzman, 1999, p. 145, in Romiszowski & Mason,

1996), evaluative case studies (e.g., Mason, Phillips, Santoro, & Kuehn, 1988, in Romiszowski & Mason, 1996), qualitative approaches based on observation and interviewing, automatic computer based recordings of student access times and dispersion of participation (Romiszowski & Mason, 1996), and transcript analyses.

Transcripts of online class group discussions are often the most obvious and easily accessible source of data available for CMC research (Romiszowski & Mason, 1996). Rourke and his colleagues (Rourke, Anderson, Garrison, & Archer, 2001) have argued that there are many educational treasures within online learning environments that too often remain locked in online transcripts but can be released through appropriate content analyses. In essence, content analysis is a research technique that can produce insightful and valid inferences from ‘naturally’ occurring raw data of textual materials—in this case, the automatically archived CMC transcripts (Bauer, 2000). In this paper, we use the terms “content analysis” and “transcript analysis” interchangeably though they can have different meanings in other contexts where the content being analyzed may not be transcripts of CMC discussions.

Analyses of synchronous CMC transcripts can decrypt the interactional patterns of group discussion and lend insight into the learning process of individuals who participate in the discussion. Such analyses can also offer data useful to gauge the efficacy of interaction among instructors and students. The analysis of the CMC transcripts can also shed light on how collaborative learning processes, trust formation, and social negotiation can be supported, sustained, or hindered (Henri & Rigault, 1996). In effect, transcripts can help reveal answers to over-arching questions such as “What communicative competences are needed to effectively participate in a synchronous CMC?”, and “How can effective participation/organization in/of synchronous CMC occur?”

Only when there is clearer understanding and insight into the complexities of CMC can specific suggestions be offered about how to make use of this medium for learning (Bruce & Levin, 1997; Henri, 1992; Peyton & Bruce, 1993). As indicated, we believe that this understanding can be derived from a finer-grained analysis of the content of the online conferencing.

Henri (1992) developed a multifaceted analytical model for content analysis of computer transcripts. At its core, this model promotes an analytical method for distinguishing different functions that messages play by classifying them broadly into cognitive, metacognitive, social, or organizational categories (Henri, 1992; Henri & Regulate, 1996). Many other researchers have used Henri’s pioneering content analysis methodology in their own CMC related research (Hara, Bonk, & Angeli, 2000; McDonald, 1997; McDonald & Gibson, 1998). In addition, several researchers have extended Henri’s content analysis by combining it with other theories and conceptual frameworks. For instance, McDonald et al (1998) adapted and combined Henri’s content analysis model with the group development model proposed by Schultz (1983) and Lundgren (1977). Another example includes Hara et al.’s (2000) use of visualizing tools to analyze online conferences in which content analysis is combined with mathematical lattice theories that allow for the visualization of CMC data through maps, graphs, and conceptual hierarchies. While such visualizations are extremely powerful representations of data, they also require extensive verbal interpretation which makes using them quite demanding.

One fundamental limitation of Henri’s model (and others based on it) is that they only produce or report the frequencies of occurrence within the various categories. Though this is useful information, the relationship among different categories is not clearly elucidated. These models examine each individual message, more as a function of language in use, without adequately considering interrelations among the messages. Thus, each message is seen as being isolated from other messages. An additional limitation of all such models has to do with the key categories themselves. Some functions or categories, such as cognitive and metacognitive processing, are

often extremely difficult to code (Hara et al., 2000). Clearly, inconsistencies in coding can negatively affect the reliability of data analysis.

Sensitive to these limitations, a few researchers and scholars have developed other tools for content analysis (Bonk, Angeli, Malikowski, & Supplee, 2001; Bonk & Wisner, 2000; Herring, 1999, 2003; Rourke, Anderson, Garrison, & Archer, 2001). These alternative methods include message flow analysis, task phase analysis, semantic trace analysis, the classification of participant types, forms of feedback, reflective interviews, observation logs, focus groups, retrospective analyses, and user think alouds (e.g., Levin, Kim, & Riel, 1990; Rice-Lively, 1994, 2000). As Bonk and Wisner (2000, p. 16) stated, "...so many methods are mentioned in the literature, it is difficult to know when and where to use them."

Despite the range of research methodologies of transcript analysis, there are some issues that have not received much attention. Some of the key issues are detailed below.

1. **Lack of focus on interactional process.** Studies tend to categorize individual messages rather than depicting the interactional process, i.e., there is lack of treatment of the relational dimensions of CMC between individuals messages, thus missing out on the complex web of interactions developed between and among teachers and students.
2. **Lack of emphasis on the dimensions of student participation.** There is huge amount of information for students to process and potentially respond to in synchronous CMC. However, there is not much known about how students decode and follow different threads of a discussion; how they choose when and how to respond to which message(s); when and how to get one's one ideas/questions heard; how to start a new thread; and how to increase the longevity of an idea or thread and generally heighten the interaction and debate among participants.
3. **Lack of focus on teaching.** Teaching online is a demanding task for teachers. For instance, consider the fact that online discussions can readily go "off-task." How is a teacher to deal with "off-task" exchanges? What kind of "off-task" discussion is positive so that teachers might facilitate an "instructional detour" and when is it negative so that online instructors should find an appropriate opportunity to draw the discussion back to the task? While millions of learners are now learning in online environments in both K-12 and higher education, not much is known about such issues.
4. **Lack of emphasis on learning.** Given the lack of the emphasis on interactional processes, dimensions of student participation, and teaching, it is not surprising that issues of learning are not appropriately highlighted in the research literature.
5. **Lack of systematic methodology.** In the context of content analysis, a systematic analysis methodology would explore transcripts for structures within the online ideas and concepts (Reber, 1995). In this area, most existing research is qualitative in nature with little consistency amongst researchers. In addition, few perform, or at least report, secondary content analyses (Rourke et al., 2001).

Most studies just present the final results while omitting cumbersome qualitative descriptions of how the results, models, or theories were derived. As a result, there is a strong need for developing systematic methodologies that can evaluate CMC discourse not only qualitatively, but also quantitatively (which can be used across different contexts). This is the research gap that the present study directly addresses. We offer a detailed case study that extends from specific data to theory. It is hoped our methodology will be replicated by other researchers.



In the following section, we offer a detailed analysis of one synchronous CMC transcript that lead to a framework for “thread theory.” This approach was inspired and influenced by grounded theory of Glaser & Strauss (1967). Also influential was Edelsky’s (1993) description of the emergence of turn-taking and floor theory through different ways of data display as well as Herring’s (1999) schematic visualization of turn-taking in CMC.

### **The data**

The main data source from which this theoretical framework emerged was a three-hour synchronous computer conference of a graduate level course (6 graduate students and 1 instructor) conducted through Blackboard Tutonet Virtual Classroom. The course was a face-to-face graduate level course with some online components (such as class listserv). The instructor and the six class members decided to turn one class meeting into a virtual session because of a forecasted storm. The topic of the discussion remained the same as planned for face-to-face session: overview of web resources project and a discussion of “Rhetorics, Poetics, and Cultures” by Jim Berlin on postmodernism. As with previous synchronous CMC sessions, this virtual meeting followed the usual three-hour time frame. Neither the instructor nor the students reported any problems with the synchronous CMC technology. The specific conferencing data used in this study was provided through an automatic recording of a conference using the “Discussion Board” feature within Blackboard. Informed consent was obtained from all the participants of this online experience, and all names provided here are pseudonyms.

### **The analysis**

Using grounded theory, a method of inductive qualitative research that utilizes multiple sources of data comparison and analyses to discover underlying social forces and arrive at a theory about basic social processes in a domain (Glaser & Straus, 1967), we conducted a fine-grained data analysis. Grounded theory often relies on case studies and well designed research problems to investigate and explain new or emerging concepts and theories (Hueser, 1999).

## **Emergence of the Thread Theory through Data Analysis**

We began by looking at one excerpt of a transcript. As is clear, synchronous CMC transcript can look quite “chaotic” (Herring, 1999). Part of the reasons for the “chaos” or incoherence is typically caused by the conferencing system employed. As was the case here, conferencing systems tend to post messages in the order it receives them. Delays may be caused by system “lag.” The system forces all messages posted into a strict linear order according to when they were received. However, such a logging or time stamping of messages may result of many unrelated messages and many messages intervening between an initiation message and its responses. As a result, ongoing conversations and interactions are disrupted or fragmented (Garcia & Jacobs, 1999). Reading a conferencing transcript, therefore, often leaves one with the impression that the discussion is like a Cocktail party—it is teetering on chaos. In Figure 1 is an excerpt from the transcript of our data set. The chaotic nature of it is obvious at first glance.

This is the original automatically recorded excerpt from the transcript. The order of the text from left to right is: message number (#128), the time the message is posted (05:45:10 pm), participant’s pseudonym (B), and the message. The indentation and the message number are added. In the sections that follow, we present the process of data analysis and the manner in which thread theory was developed.

To begin, we choose an excerpt from the three hour synchronous conference and we displayed it in several ways. For instance, we used different colors to mark messages dealing with one topic or theme. Unfortunately, this did not work well since the colored data was still in the original linear order (as opposed to the interrelated nature of the discourse) and the “real” interactional patterns were not being visually captured.

Mess No.	Time	Parti	Message
# 128	05:45:10 PM:	B	I have a question...
# 129	05:45:22 PM:	C	with people? but I can make them into pdf and upload, but it is a lot of work
# 130	05:45:28 PM:	B	will the number of resources depend on the extent of resources in the field we're looking at?
# 131	05:45:45 PM:	F	Noise? I hear nothing...
# 132	05:45:52 PM:	C	my question is first, :)
# 133	05:45:58 PM:	B	in response to C --we can just cite papers and books, right? no need to link to everything
# 134	05:46:01 PM:	E	A loud gong noise when you came in.
# 135	05:46:05 PM:	G	logged in
# 136	05:46:14 PM:	D	C: no need to make them PDF files; only link to articles that are already online (you don't have to put the articles online yourself)
# 137	05:46:37 PM:	D	hi F!
# 138	05:46:39 PM:	G	Uh...hello? Is this working?
# 139	05:46:46 PM:	G	hi--sorry to take so long
# 140	05:46:50 PM:	F	Oh--that. I heard it for the first time. By the way, it is hard to catch up with the conversation if everytime I scroll up to read, someone comes in and the screen drops back down. So I don't know what all you've said.
# 141	05:46:52 PM:	C	so you mean all the resources should be online ones
# 142	05:47:16 PM:	B	NO! You can just reference paper resources.
# 143	05:47:23 PM:	E	In response to B and C, I think my journals resources list cites things only available offline as well as links to on-line stuff. Jim is this what you mean?
# 144	05:47:46 PM:	D	you can enlarge the chat scroll ... by pointing your cursor at the border between the chat scroll and the whiteboard and adjusting.
# 145	05:48:08 PM:	D	to clarify: sources should be BOTH print and online sources.
# 146	05:48:17 PM:	F	D--in the project, you asked some questions, like should we get permission to link. Are we to answer these questions in the project itself, or do we figure this out as a group ahead of time?
# 147	05:48:34 PM:	F	and thanks for the enlarging screen advice

Figure 1: An excerpt from a synchronous conferencing transcript.

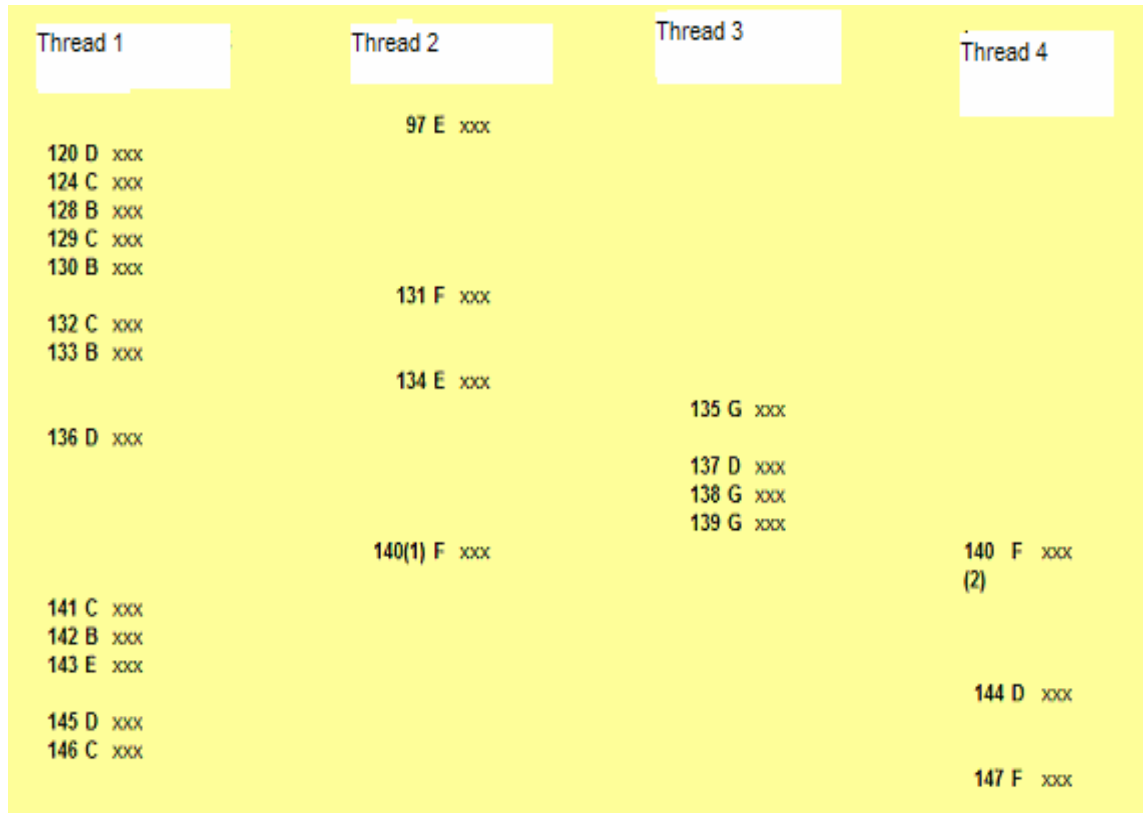
### Step 1. Choose an excerpt from the whole data set and take a closer look

Next, we rearranged the messages in our best guess at the intended order. As was shown in Figure 1, the online discourse looks quite chaotic and does not make much sense at first glance. A scrutiny of the content, however, provides an idea about what is occurring in the rapid flow of messages. One theme is about the “course project”—message #128, #129, #130, #132, #133, #136, #141, #142, #143, #145, and #146 all fall into this theme. Message #131 (posted by F, hereafter, the same)—“*noise? I didn't hear nothing*” relates to the first theme or thread and it is actually a response to message #97 (E) (which is too distant to be shown in Figure 1) – “*A loud gong noise when you came in.*”

It is possible to trace other message connections. For instance, Message #131 (F) in turn was responded to by message #134 (E) – “*a loud gong noise when you came in.*” The first part of message #140 (1) (F) – “*oh that-I heard it for the first time*” is a response to message #134 (E).

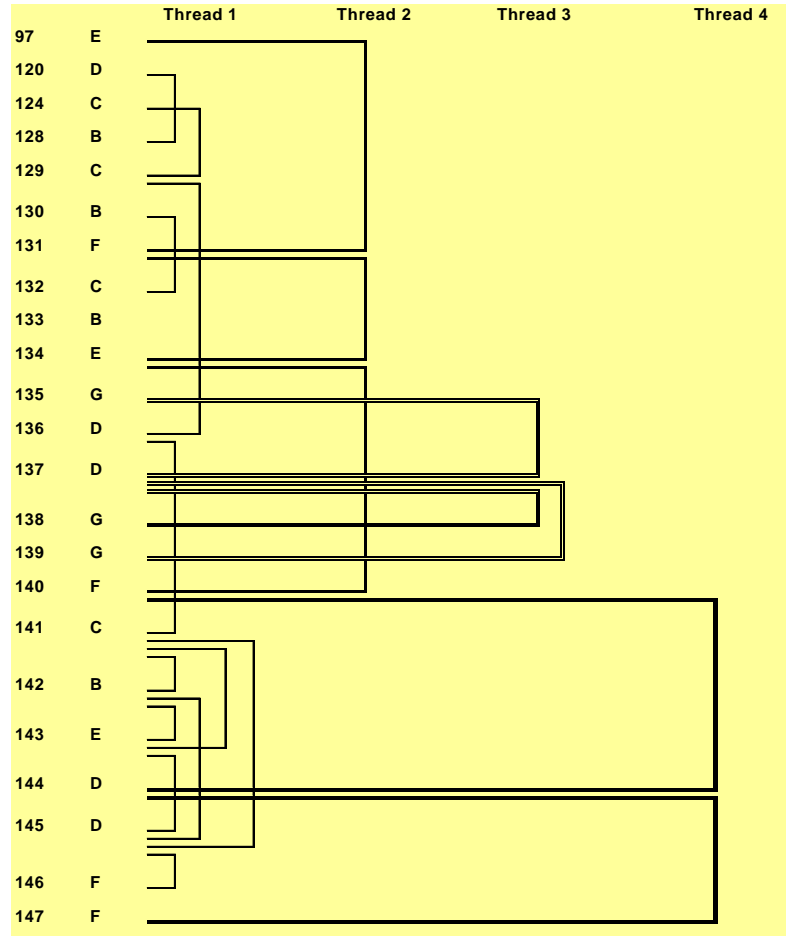
Messages #97, #131, #134, and #141 (1). Therefore, this particular message falls into the second theme/thread in which F is figuring out what E means while E is bantering his late coming. Messages #135 (G), #137 (D), #138 (G), and #139 (G) fall into the third theme/thread, where G arrives late and D greets him. Messages #140 (2) (F), #144 (D), and #147 (F) fall into the fourth theme/thread, where D and F are dealing with technical problem, with F raising questions in Message #140 (2) and D responding by posting message #144 to help. Detailed in Figure 2 is the rearrangement of the messages in their apparent “intended” order, i.e., messages dealing with specific themes are arranged together in vertical columns (threads).

This way of data display reveals that the conferencing discourse is coherent in its unique way: parallel themes/topics are going on in a certain temporal and spatial frame. Those messages that look fragmented or “chaotic” are like an entangled pearl necklace. There are actually identifiable lines/strings of coherence, though, that run through those seemingly scattered pearls. Such lines of coherence are underlying strings that link these pearls. We call these synchronous chat messages together with their underlying strings “threads.”



**Figure 2: Rearrangement of the messages in their “intended” order from message #97 to 147. The messages fall into four parallel themes/threads.**

In addition to the parallelism of threads, some other characteristics of threads are revealed more clearly when we display the data in still another way—a schematic visualization of the threads inspired using Herring’s (1999) research (see Figure 3). Using Herring’s methodology, lines are often not drawn between pairs of adjacent turns since they often fall into different threads or ideas.



**Figure 3. Schematic representation of interaction from message #97 to message #147**

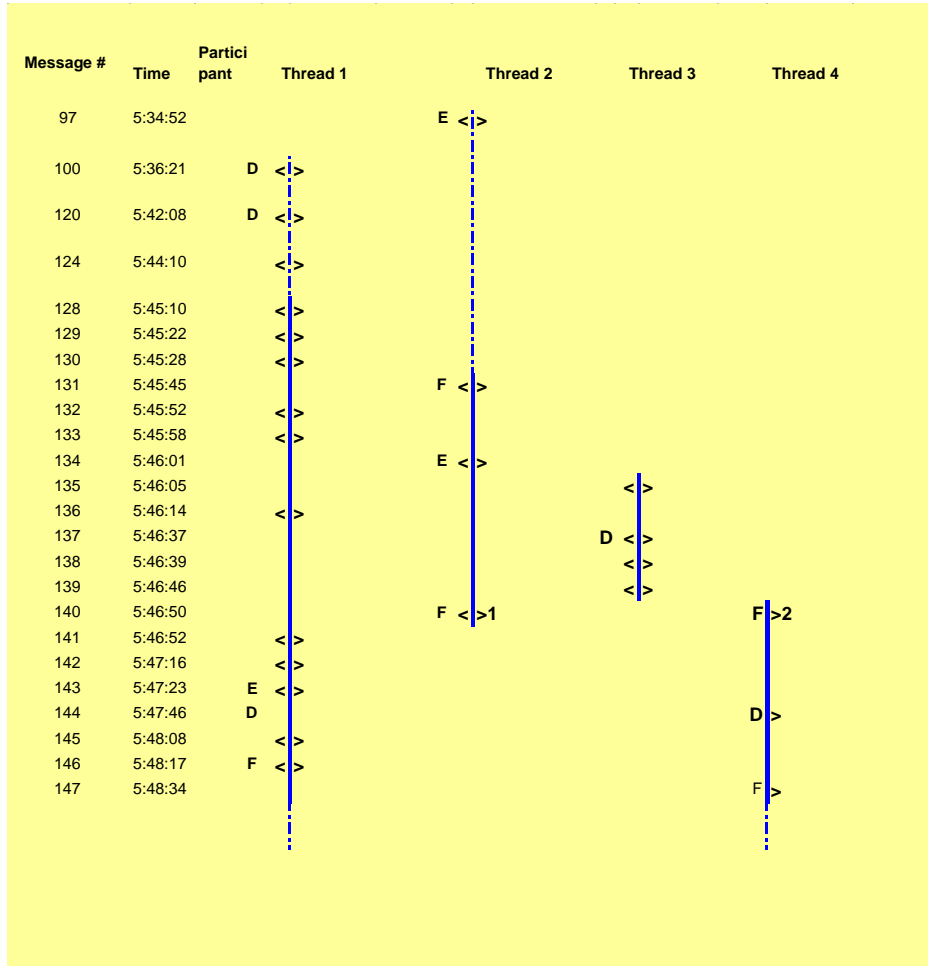
From this representation of the transcript excerpt, we can see the non-sequential, non-linear appearance of synchronous messages more clearly. This is the phenomenon of “disrupted turn adjacency” (Herring, 1999), i.e., the succession of one thread being disrupted (but not “broken”) by intervention of other messages belonging to other interleaved threads. In this sense, threads “jump.”

Another important fact that emerges from reviewing these representations is that participants tend to multitask, i.e., they participate in more than one concurrent thread at a time. Such multitasking is apparent when including the initials of the participant next to the messages they sent. As is shown in Figure 4, four threads parallel and extend from 5:34:52 to 5:48:34 with messages from #97 to #147. As marked or noted to the left of each thread, Participants D, E, and F contributed to more than one thread simultaneously. Also notice that participant F in one message actually posted to two threads at the same time (as indicated by the F <1> and F <2> in Figure 4).

An additional interesting phenomenon and characteristic of threads is that they resist closure. In effect, a thread may not be completed or terminated before other threads come into being (Shi, 2001).

The discovery and the depiction of the characteristics of threads have strong pedagogical implications. For instance, knowing the parallel nature of threads is important for an instructor in

facilitating/moderating a discussion. There are often certain thread(s) that the instructor intends to force/push forward; typically those are in line with the announced course agenda. The instructor will try to keep the discussion “on-task” through fostering (i.e., nurturing, forcing, nudging, etc.) the on-task thread (herein called target threads). In contrast, as noted earlier, in an “off-task” thread, the instructor needs to decide whether to follow them and do an “instructional detour” or try to possibly bring them to an end.



**Figure 4. Participants are “multitasking”.**  
**Participants D, E, F are taking part in several threads simultaneously**  
 (Note: only names of participants who multitask are represented).

At the same time, the instructor often needs to summarize the state of the discussion and find unifying threads in participants’ comments. Feenberg (1989) refers to such summary commenting and unifying remarks as “weaving.” According to Feenberg, weaving comments from an instructor or moderator interpret the discussion by drawing its various threads together in a momentary synthesis that can serve as a starting point for the next round of debate. “Weaving comments allow on-line groups to achieve a sense of accomplishment and direction. They supply the group with a code for framing its history and establish a common boundary between past, present and future.” (p. 35). Knowing that threads resist closure helps an instructor realize the importance of connecting loose ends and strengthens conceptual linkages or coherence while keeping the chain of conversation going. The concepts of target thread and side threads as well as

dependent and independent side threads discussed in the next section will help clarify some of the key pedagogical issues in synchronous CMC.

To sum up, these multiple representation of a small excerpt of data reveal some of the defining characteristics of threads; specifically, (1) threads parallel; (2) threads jump; (3) threads have multitaskers; and (4) threads resist closure. However, the fact that our conclusions are based on just a small subset of the data raises the question of whether such patterns are local to the data currently being analyzed or whether we have discovered patterns that would be true of the synchronous CMC data set as a whole. Answering this question leads us to the next step of data mining; namely the timelining of the entire data set.

## Step 2. Timelining the data set.

Following approaches of discourse analysis (Erickson & Shultz, 1981; Florio-Ruane, 1987; Sacks, Schefloff, & Jefferson, 1974), we timelined the first period of the three hour conference. In terms of this research, we viewed a timeline as a presentation of a chronological sequence of events in the synchronous CMC class meeting. Here, such a timeline relates to the detailing the scenarios of the synchronous conferencing along a drawn line that enables a viewer to readily understand temporal relationships. The synchronous CMC timeline divided the conferencing discourse into several phases (see Figure 5). There were a total of 367 messages produced within a time period of 1 hour 32 minutes and 33 seconds. In terms of Figure 5, our analyses focused on the second and the third phase where the conference was dealing with the two main course agendas—*web resources projects* and *James Berlin postmodernism discussion*. The time-lining disclosed several new phenomena and stimulated a couple of important questions.

On the left-hand side of Figure 5 is the timing of message posting (automatically archived) and the serial number of messages (added). The middle depicts the various timelines. The right hand side indicates how many times the instructor made efforts to draw the off-task threads back to task as well as the coding category of different messages.

Timelining offers a means to represent and understand a large data set in a manageable manner. Using this tool, a researcher can explore smaller parts of the data along such timelines and examine patterns found from a subset of the data or a transcript excerpt. As shown, synchronous conference discourse patterns, including the parallel nature of threads, the disrupted adjacency of turn taking—“jumping” threads, multitasking in different threads, and closure resistance within threads—are somewhat ubiquitous; they are happening all the time and taken for granted.

Another phenomenon revealed by timelining the data is that the conference goes off-task very frequently, i.e., the chat drifts away from the target thread and many other new threads or side threads develop. In a study of synchronous conferencing in the military, Orvis et al. (2002) found that nearly thirty percent of synchronous postings were off-task threads. In fact, only 55 percent of the more than 6,600 chat acts coded in that particular study were deemed task related. In the present study, the first part of the conference was supposed to follow the course agenda proposed by the instructor (D) in message #69:

*#69 5:13:28 D first part of class is (a) web resources project overview, and (b) Berlin (from reading list) discussion.*

These two tasks were supposed to be developed into target threads one after another. The conference started to discuss the first course agenda from 5:13:28, message #69, and ended at 5:55:55, message #178. During this period, it went off-task ten times, which meant that ten side threads were initiated. When dealing with the second agenda, from 5:55:58, message #179, to 6:26:06, message #357, the conference went off-task another six times. All these threads which diverge from the target thread, we label “side threads.”

Time	Message	Message
4:53:44	1	social greetings
5:13:24	68	
5:13:28	69	1st time off-topic
5:36:21	99	
5:36:30	100	2nd time on and off topic
5:42:08	120	3rd time on and off topic
5:55:58	178	
5:56:31	179	1st time
6:06:24	219	2nd time
6:16:22	288	6th time
6:16:43	291	Finally!
6:25:01	358	Negotiating class break
6:26:52	367	class is over

**Figure 5 Time-line of a portion of the synchronous CMC data set.**

What did the instructor do when the discussion went off-task? To answer this question, we explored how the instructor taught and “facilitated” the synchronous conferencing session. From this analysis, it was clear that on three occasions he attempted to draw the discussion back to task when the discussion was dealing with the first course agenda item and seven times when the discussion was dealing with the second item. Interestingly, the instructor’s efforts did not always work as intended. Also of interest is the fact that Cazden’s (1983, 2001) I-R-E pervasive sequence of classroom discourse was difficult to find in the virtual discussion. The discussion was deepened, widened, and accelerated at a much faster pace than it probably would have with an instructor standing at the front a physical classroom space. We often saw the reversal roles with students initiating questions, instructor replying, and students making evaluative comments. In effect, the instructor became a student in his own class.

In some regards, this is the most important finding of the study—the teacher’s authority was decentered in synchronous CMC. This result echoes Lyotard’s *postmodern condition* of knowledge, the teacher’s role as guarantor of authority – providing the “metanarrative” that gives coherence—was disrupted when the class was using electronic discussion. However, this does not

mean that the role of an instructor is less important or an instructor could do nothing but merely “let it go” in any direction. Instead, the talents of the instructor are culled at all times to determine when to allow the class or a part of the class to explore new ideas or comments, when to pull back to a key topic or point, when to question, when to push to explore, when to ask for participants to articulate their ideas better, when and where to insert questions or cues, and when to explain or elaborate on an idea (Bonk & Kim, 1998). In effect, teaching online is the ultimate example of Tharp and Gallimore’s (1988) notion of assisting in the learning process instead of assessing it (see also Tharp, 1993). Others might look at it as a cognitive apprenticeship or teleapprenticeship (Collins, 1990; Collins, Brown, & Newman, 1989), but the focus is the same—there is a shift from directly teaching something to someone to creating an environment wherein learning is socially determined instead of predetermined. If the act must be labeled teaching, then it should be termed “active teaching.”

One example that the instructor in this particular study made active teaching was that while making efforts in pushing forward the course agenda, he also assisted with the initiation of some side threads and made various “instructional detours” (Clark & Brennan, 1998) so that the conference could go smoothly. For instance, the instructor called the class attention in message #179 and 180 to move on to the second task—*talking about James Berlin*:

179 5:55:58 D *are we ready to talk about Berlin?*

180 5:56:31 D *I liked your in-depth responses ... as well as the responses to the responses*

The initiation of the target thread was not well responded. Participant A in the immediate posting message #181 raised a question that was not relevant to the initiation of the target thread--it seemed that he felt that the first task/topic had not yet been fully discussed. He questioned the role of the web project (the content of the first course) and initiated a side thread (side thread 2.1) – the role of the web resources project, rather than the content of it:

181 5:56:40 A *I'd like to ask about the role of the web resources project in relation to the other class assignments.*

The instructor followed the initiation of this side thread, and, not surprisingly the balance of the class followed along. Instructor (D) did make these types of instructional detours when dealing with the initiation of other two side threads (side thread 2.2, 2.3, and 2.5) by following and actively responding to the initiation of these side threads. Occasions of learning was believed to take place during these active teaching detours (Clark & Brennan, 1998).

Another sign of active teaching occurred when the instructor found an appropriate entering point to cut in and drew the class back to the target thread when a side thread lacked focus or meaningful discourse. For instance, in message #171, he attempted to bring the discussion back to an agenda item when one participant talked about his own final project while the target thread was supposed to deal with the midterm project. He chose this as an appropriate entering point and quite naturally and successfully drew the class back to target thread.

As detailed above, the time-lining the synchronous data disclosed several phenomena and stimulated a couple of key questions. While we highlighted some of these phenomena in the above sections, we now turn to the questions stimulated by the timelining.

Some of the major questions in this research project were: what are people doing when they go “off-task?” How are “off-task” threads initiated? How are the off-task threads related or not related to on-task threads? What is a good way to map out synchronous interaction patterns—if specific synchronous patterns actually exist? Such questions stimulate the next step of data analysis—threading the whole data set and mapping the initiation of threads and decoding interrelationships of the threads. During this process, ideas related to *independent side threads*



and *dependent side threads* emerge. The pedagogical implications of these concepts (the categorization of threads) were reflected in the previous section and will be revisited later.

### Step 3. Threading the data set and mapping interrelationships of threads.

To address some of the questions raised in the second step, we threaded the first half of a three hours synchronous data set. However, this process produced a map which was too large to insert or explain here. Naturally, some interesting interaction patterns surfaced on this map. In Figure 6 is an excerpt from this enormous map.

In Figure 6, the target threads are placed on the left side. The side threads are laid out individually (i.e., in columns) on the right side of the map, while key words related to the initiation of each thread are noted at the top of each side thread. A detailed analysis of the content of each thread warranted the creation of the concepts “*independent side threads*” and “*dependent side threads*.”

As we mentioned in the last section, in message #178 and #180, the course instructor (D) intended to push the discussion to the second course agenda—the Berlin discussion. It was also noted that the discussion did not parallel the target thread initiated by the course instructor; rather, the whole class (including the instructor) followed the initiation of the side thread. After about 20 turns (each posting refers to a turn), Participant F in message #205 put forward a debate about whether literature could be used to teach writing or not. This is an extension of the second target thread, the Berlin discussion, which mainly dealt with the social theories of writing.

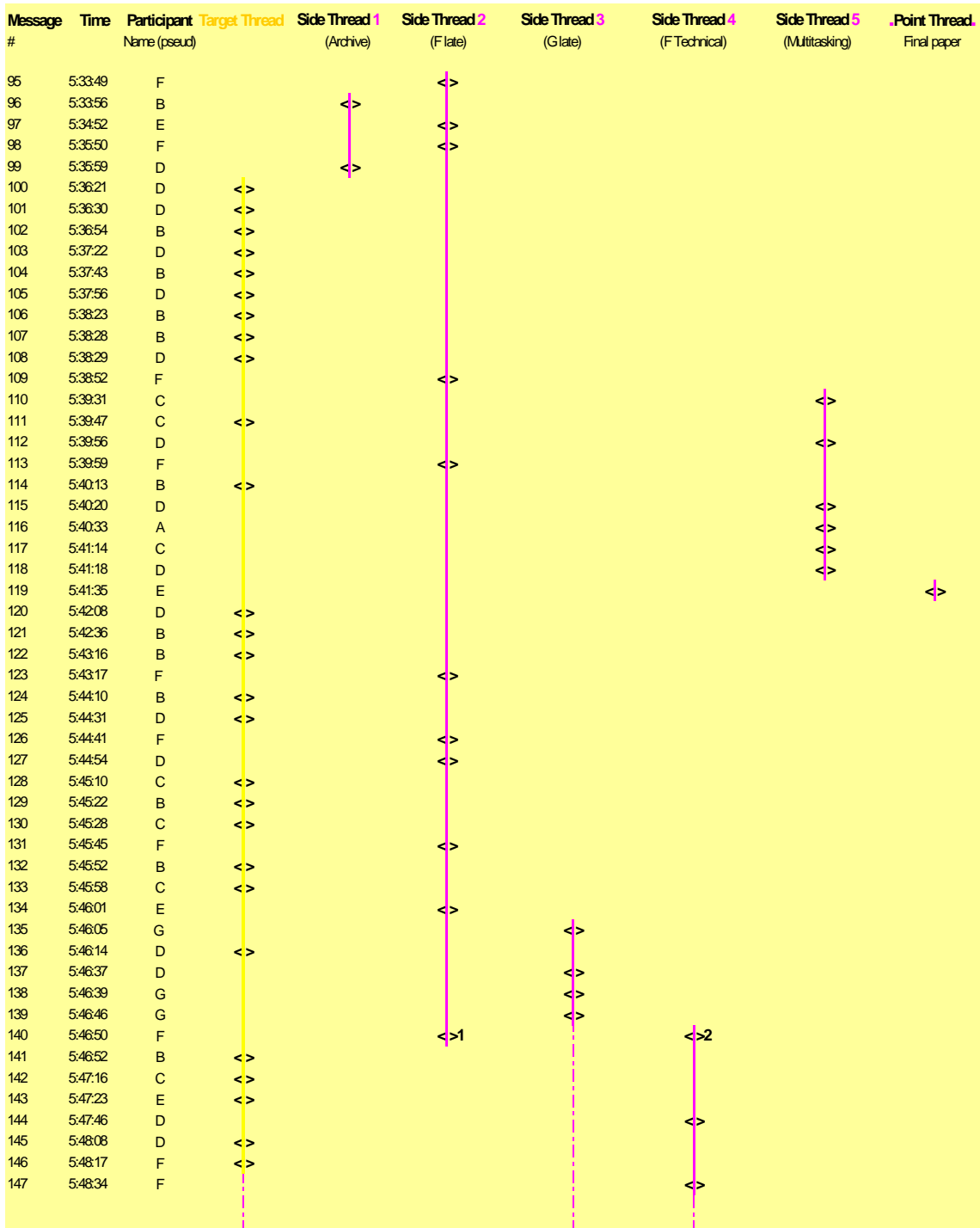
*#205 6:03:57 F Because it had come up at my institution, I'm interested in the debate between those who use literature and those who don't to teaching writing. While it may seem that others have moved beyond this debate, I still see both types of classes being taught. Would exploring this topic be ok? or would it just be rehashing old stuff to most (but not me).*

This side thread, discussion of the relationship between the teaching of writing and the teaching of literature indicated that the learner integrated what he had learned with other information and applied what he had learned to a new situation. It was not a direct reference of the readings of Berlin, though. The initiation of this side thread aroused “heated debate.” We refer to this type of side thread as a “*dependent side thread*” since it is indirectly related to the target thread. In contrast, “*independent side threads*” are unrelated to the target thread content. The following two messages are independent side threads in relation to the first target thread which dealt with the first course agenda item, “web resources project.”

*#166 5:53:12 D I'm not feeling 100% myself, G -- something is going around.*

*#167 5:53:19 B hi, G, sorry to hear that you are sick*

Of course, off-task behavior is not always negative. Such social discourse creates shared knowledge which participants can use in later postings and they help build intersubjectivity among participants (Resnick, Levine, & Teasley, 1991; Schrage, 1990). Sociocultural theorists indicate that these common values and understandings help learners negotiate meaning, build new knowledge, and restructure problems in terms of the perspectives of another (Bonk & Kim, 1990; Diaz, Neal, & Amaya-Williams, 1990). From this perspective, the initiation of *dependent side threads* is more of a plus than a minus. According to Henri (1992), learning can be said to be significant when the learner seeks information actively, uses it to produce knowledge, and integrates these into his or her cognitive structures. The above discussed side threads are cases when learners seek information actively and use it to produce knowledge. The initiation of the several dependent side threads activate lively, intense, and heated discussion where all the participants are attracted, contribute to the discussion, and perhaps feel a sense of ownership over their own learning.



**Figure 6: An excerpt from a synchronous data set**

This way of displaying data stimulates a plethora of “aha!” moments. The “off-task” threads are pervasive--it seems they are a rule rather than exceptions. However, the “distance” of the “off-

task” threads in relation to “on-task” threads is different—*dependent side threads* are distinctively closer in that they are loosely associated with the target thread but are actually an extended and further development of the target thread. It may be at those side threads wherein higher-order thinking (e.g., interesting connections or linkages), insightful individual contributions (e.g., engaging metaphors), and student self-regulated learning occurs.

Mapping the threads in one big map also allows one to observe the many different dimensions/attributes of synchronous CMC threads. Threads have life. Some last a long time (by chat standards), while others have an extremely short life. Some cut across dozens of messages (like thread 2 in Figure 6 which cuts across 34 messages), while some die as soon as they come into being—called *point threads* (see Figure 6). Some threads are extended tenuously, while others flow intensely on and on in “much heated debates.” Some threads attract most of the session participants, while many simply live on as dyadic conversations. A conceptual framework of a “thread theory” thus comes into being.

## The Thread Theory:

### A Conceptual Framework for Analysis of Synchronous CMC Transcripts

The following is a brief description of what we call “thread theory” (Shi, 2002, Shi & Tan, 2003). Our thread theory consists of the following four components: (1) the definition of a thread, (2) characteristics of threads, (3) types of threads, and (4) a method of quantitatively measuring (quantifying) the different attributes of a thread.

**Defining “Thread.”** A *thread* is a series of related messages on a topic or a theme in real-time, synchronous CMC, extended through turns. Threads are selected and developed when participants initiate and respond to each other. Each message, like a pearl in a string, can be seen as an independent or individual comment, which means that they can express one or more ideas, but they are also connected through the underlying string, strongly or tenuously.

The thread theory proposes four characteristics of a “thread,” and provides reasons and pedagogical implications for each of these characteristics. First, as noted earlier, *threads “jump.”* The jumping of threads refers to the non-sequential, non-linear appearance of messages in synchronous CMC, or the phenomenon of disrupted turn adjacency (Herring, 1999). That is, the succession of one thread is disrupted (but not “broken”) by the intervention of messages belonging to other interleaved threads. The research literature in this area usually attributes this primarily or solely to the apparent system lag. However, this paper proposes two other reasons related to group interaction dynamics and accordingly explains how to create visuals for “jump reading” when analyzing a transcript. Second, *threads “parallel,”* which refers to the simultaneous development of multiple threads in a certain temporal and spatial frame. The notion of parallel threads provides a basis for discussing the communicative competence needed to effectively join a synchronous chat. Third, *threads resist closure.* The initiation of a new thread is usually not the result of the ending of a previous thread. The theory describes how synchronous CMC acts out Bakhtin’s “principle of multiaccental nature of sign” and the “dialogic centrifugal forces of multiplicity, equality, and uncertainty” (Faigley, 1992, p. 183). Fourth, *threads could have “multitaskers,”* which refers to synchronous CMC’s capacity for participants to be simultaneously engaged in multiple threads.

Next, thread theory proposes and describes three types of threads. One common phenomenon in synchronous CMC is that it easily and frequently wanders off line. To help understand the reasons and patterns of this kind of “wandering-off-line,” we introduced the concepts of *Target Thread*, *Side Thread*, and *Point Thread*. Of these types of threads, side threads are further subdivided into *Independent Side Threads* and *Dependent Side Threads*. As indicated in this manuscript, there are strong pedagogical implications for the categorization of threads. Some

implications include how “off-task” discussion happens; why “off-task” discussion is not always negative but sometimes positive; how instructors deal with “off-task” threads by making “instructional detours,” and finding an appropriate “entering point” to render a thread a “point thread” and possibly draw the discussion back to the target thread.

Finally, there is a need for a model for assessing the different dimensions of a thread and the “Total Value” of a thread. In short, the total value of a thread is the average of three attributes of the thread: Intensity, Magnitude, and Captivity:

The Total Value of a thread equals the Intensity .a + Magnitude .b+ Attraction .c (a, b, and c are the weight coefficients).

***Life of a Thread.*** Threads have life. The life of a thread refers to the number of messages a thread crosses from its starting point to its ending point. Larger value means a longer life expectancy, while small value means a shorter life expectancy.

***Intensity of a Thread.*** Threads have intensity. The intensity of a thread is defined as the number of messages contained in one thread compared to the number of messages the thread crosses (i.e., its life). In effect, thread intensity is the number of message that it crosses divided by the starting message for a thread minus the last or ending message of that thread. For instance, the intensity of Thread 2 and Thread 5 in Figure 6, is  $11/(141-96)$  and  $6/(118-110)$ , respectively, or  $11/45=0.244$  and  $6/8=0.75$ ). Using this procedure, the intensity of Thread 5 is greater/stronger than that of Thread 2. Smaller values indicate that a thread is thin and tenuously associated, while larger values indicate that a thread is strongly associated (i.e., the discussion is “heated” or “hot”).

***Magnitude of a Thread.*** Different threads have different degrees of magnitude. The magnitude of a thread is defined as the number of messages of a thread compared to the total message number within a conference session.

***Captivity of a Thread.*** Different threads have different degrees of captivity. Captivity is defined as the number of participants in one thread compared to the total number of the group participants. The larger the value is the higher degree of captivity a thread has.

## Significance of the Study

The conceptual framework of the thread theory provides a systematic set of concepts and a quantitative method to analyze synchronous CMC data. The method of threading, the extracting of the characteristics of threads, and the categorization of threads as well as the concept of the life of a thread, intensity of a thread, and magnitude of a thread all have strong theoretical and pedagogical implication to the area of CMC research.

***The Interactional Process.*** The major advantage of the thread theory is to provide an analytical method to examine the interactional process of synchronous CMC. As online learning opportunities explode, understanding online interaction and engagement is vital. Kuehn (1994) asserts that more studies are needed to “explore the relational dimensions of computer-mediated communication in instructional contexts” (p. 177). Therefore, this study develops an analytical method applied to the content analysis of synchronous CMC and also demonstrates its application using the framework of the theory to analyze a synchronous CMC transcript.

***Learning.*** As opportunities for synchronous learning proliferate in the coming decade, thread theory will have increasing significance for students and their learning as well as the instructors attempting to moderate or enhance it. The description of thread characteristics and attributes provided here demonstrates that there are many different types and functions of threads. It also reveals the huge amount of information that participants must process at a rapid pace or tempo. It is also clear that students in synchronous environments need be more sensitive to audience

issues—when and how to respond to which message(s); when and how to get one’s one ideas/questions heard (i.e., how to start a new thread); and how to provide supports for longer life, high value, high impact, and a strong degree of attraction. Few studies have been conducted to provide such information. The analytical method proposed here can be utilized in synchronous training and linked to other pedagogical methods that can help online students and instructors enhance their communicative competence to take part in synchronous CMC.

**Teaching.** In terms of teaching, a “decentering of authority” (Cooper, 1999) is apparent in these synchronous learning environments, including the one studied here. By disrupting traditional pedagogical arrangements, synchronous CMC demands that teacher’s role shifts from evaluator to moderator and occasional co-participant. However, this does not mean that teachers become less important to student learning or the learning environment as a whole; on the contrary, the instructor constantly nudges, prompts, and scaffolds student learning here. The instructor may be a manager of learning and nurturer of discussion and debate one minute and a social convener or a technology support person the next (Bonk, Kirkley, Hara, & Dennen, 2001).

Given the range of required instructional roles, it is clear that synchronous tools are typically more demanding on the teacher. One of the most important demands of a online instructor in synchronous CMC is the “art of weaving”: unifying discourse through comments, summarizing major points, pulling together numerous disjointed threads, and integrating the various participants’ contributions. But how do instructors acquire this craft? This is an area that is yet to be explored. Our analysis of synchronous CMC transcripts can provide teachers with some teaching insights or models by bringing to light common and to-so-common patterns as well as some of the prevailing characteristics of synchronous CMC. At the same time, instructors surely need to experience synchronous CMC themselves and explore the vast potential through both theoretical and practical dimensions.

**Systematic methodology.** The study is a sample case of how to move from data to theory in a rich synchronous learning context. The concepts, characteristics, and themes all arise from the data provided. Other researchers can now replicate, extend, modify, and perhaps even refute our findings. Though we organize the process in steps, the actual process of the data analysis was admittedly more of a trial and error enterprise.

## Limitations and Future Research

The current study is the first stage of the development of an analytical and evaluative method for analyzing synchronous computer mediated communication. The next stage of the study is two fold: (1) to evaluate the total value of a synchronous conference by weighting different categories of threads, and (2) to apply the framework to broader context to test its generalizability and pragmatic potential.

While it has many advantages for understanding the pedagogical potential and learning outcomes of synchronous conferencing, thread theory has many definite limitations. First of all, synchronous CMC is an incredibly complex activity which thread theory might oversimplify. There exist many important variables to study in each different synchronous conference, including those related to the subject matter, number of participants, duration of the conference, familiarity and frequency of using synchronous CMC, course level, and existence of an instructor or moderator or multiple online instructors. All we have done here is apply thread theory to one synchronous CMC transcript or situation. More applications of thread theory and procedures to different conferences involving additional variables or blends of variables are needed. The testing and application of thread theory will likely highlight key flaws and inadequacies wherein the framework can be improved.

At this point, the framework used here is still just a research tool. To make thread theory easily and practically used in ordinary online classroom evaluation, there needs to be clear and easy to apply definitions, classifications, and identifications of each category, each attribute, and each step. We push on.

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## About the Authors

**Dr. Shufang Shi** is an assistant professor in the Childhood/Early Childhood Education Department at State University of New York Cortland. She is the Chief Researcher for CCC Confer, a state-wide e-conferencing project serving 109 California colleges in the California Community College system. Shufang received her Ph.D. in instructional technology from College of Education, Michigan State University. While conducting her dissertation research, she was a recipient of Spencer Research and Training Grant. Prior to her doctoral studies, Shufang was an Associate Professor at Shanghai Jiao Tong University where she received Excellent Young Teacher Award. She can be contacted at [shis@cortland.edu](mailto:shis@cortland.edu) and her homepage is at <http://web.cortland.edu/shis/>

**Contact information:** 600 Warren Rd. Apt.8-3F, Ithaca, NY, 14850.  
Email: [shis@cortland.edu](mailto:shis@cortland.edu). Tel: (607) 342-2828.

**Dr. Punya Mishra** is assistant professor of Learning, Technology and Culture at Michigan State University. He also has research affiliations with the Communication Technology Lab (CTL) and the Media Interface & Design (MIND) Lab, both at MSU. His research has focused on the theoretical, cognitive and social aspects related to the design and use of computer based learning environments. Dr. Mishra is also an accomplished visual artist and poet. More information is available at <http://punya.educ.msu.edu/>

**Contact information:** Michigan State University, 509A Erickson Hall, East Lansing, MI 48824.  
Email: [punya@msu.edu](mailto:punya@msu.edu).

**Dr. Curt Bonk** is Professor of Educational Psychology as well as Instructional Systems Technology at Indiana University. Dr. Bonk is also a Senior Research Fellow with the DOD's Advanced Distributed Learning Lab. Dr. Bonk is in high demand as a conference keynote speaker and workshop presenter. He is President of CourseShare and SurveyShare. More information is available at <http://mypage.iu.edu/~cjbbonk/>

**Contact information:** Indiana University, 201 N. Rose Avenue, Department of Counseling and Educational Psychology, Bloomington, IN 47401.  
Email: [cjbbonk@indiana.edu](mailto:cjbbonk@indiana.edu).

**Dr. Sophia Tan** is an Assistant Professor at Coastal Carolina University. Her research interests include computer mediated communication, computer supported social networks, and design and development of technology-rich learning environments.

**Contact information:** Coastal Carolina University, P.O. Box 261954, Conway, SC 29528-6054  
Email: [stan@coastal.edu](mailto:stan@coastal.edu). Tel: (843) 347-3161.

**Dr. Yong Zhao** is a professor in the Learning, Technology, and Culture program at the College of Education, Michigan State University, where he also directs the Center for Teaching and Technology and the US-China Center for Research on Educational Excellence. Dr. Zhao is University Distinguished Professor at Michigan State University. His research interests include teacher adoption of technology, on-line education, and the diffusion of innovations. More information is available at <http://zhao.educ.msu.edu>

**Contact information:** Michigan State University, 115D Erickson, East Lansing, MI 48824  
Email: [zhaoyo@msu.edu](mailto:zhaoyo@msu.edu)

**Editor's Note:** In London, Peter Oriogun used content analysis of online transcripts to study quality of interaction, participation, and cognitive engagement. New tools developed by the London Metropolitan University were used to improve inter-rater reliability.

## **Content Analysis of Online Transcripts: Measuring Quality of Interaction, Participation and Cognitive Engagement within CMC Groups by Cleaning of Transcripts**

**Peter K Oriogun**

### **Abstract**

*In this article the author addresses a number of issues relating to inter-rater reliability of computer-mediated communication (CMC) message transcripts. Specifically, recoding of a semi-structured CMC message transcripts within the categories of a recently developed inter-rater reliability method called a Transcript Reliability Cleaning Percentage (TRCP) for measuring the level of online groups engagement with respect to 'participation' and 'interaction'. The author used another relatively new approach (both methods developed at London Metropolitan University), called SQUAD as a framework within which to measure the cognitive engagement of online groups. A case study is presented to examine online participation, interaction and cognition within groups using the TRCP inter-rater reliability method and the SQUAD approach. It is argued in this article that it is possible to obtain 100% inter-rater reliability agreement when using 'message' as the unit of computer-mediated communication (CMC) transcript analysis. It is further argued that it is time consuming to perform such exercise, and that this is the reason that few researchers using quantitative content analysis of CMC transcripts have published results derived from a second content analysis. It is claimed that the experiment conducted in this article with TRCP inter-rater reliability method has informed the SQUAD approach to online discourse.*

### **Introduction**

In this paper the author adopts a recently developed method for cleaning online transcripts called a Transcript Reliability Cleaning Percentage (TRCP) within another recently developed and validate semi-structured approach to CMC discourse called SQUAD (Oriogun, 2003b), as a framework to measure software engineering students' interaction, participation and cognitive engagement within online groups.

According to (Oriogun, 2003a; Oriogun and Cook, 2003) the TRCP inter-rater reliability method defines *Participation* as extending the suggestion for criteria for grading graduate-level student participation in a CMC classroom as reported in Hutton and Wiesenber (2000). The criteria are as follow:

- Evidence of completion of readings
- Relevance: the student's comment moves the discussion forward
- Logic: the points are expressed and elaborated well
- Insight: the points reflect a creative or novel approach
- Referencing other students' notes in their own comments
- Acknowledging the work of others: agree, debate, question, synthesize, or expand
- Appropriate etiquette (no 'flaming' or sexist/racist remarks)

In the same articles (Oriogun, 2003a; Oriogun and Cook 2003) *Interaction* was defined along the lines of Fahy (2001), where the meaning of the interaction must be something obvious and constant within the transcripts, and it reflects the interaction of the readers' knowledge and experience with the text in the message. Irrespective of what the writer intends, what the readers understand is based on the interaction between the message and the readers' experience, knowledge, and capability for understanding the topic. TRCP inter-rater reliability method further extends Fahy's definition, by offering the following criteria for grading graduate-level student interaction in a CMC discourse:

- Low Interaction: resolving conflicts within the group
- Medium Interaction: offering alternative solutions to group problems and offering to deliver relevant artifacts for the group's common goal
- Active Interaction: delivering relevant artifacts for the group's common goal

In this article, the author empirically validates the Transcript Reliability Cleaning Percentage (Oriogun, 2003; Oriogun and Cook, 2003) using the SQUAD approach as a framework. Furthermore, the author will use the method suggested by (Oriogun, Ravenscroft and Cook, 2005) to realise the cognitive engagement attributed to online groups using the *Practical Inquiry* Garrison et al (2001) model as a framework for the case study presented, using the alignments suggested by one of the developers of the Transcript Analysis Tool (TAT) Fahy (2002) at sentence level to assess students' cognitive engagement within online groups as suggested by (Oriogun, Ravenscroft and Cook, 2005).

### **Garrison et al. Cognitive Presence: Community of Inquiry Coding Template**

As content analysis protocols that exist today do not cater for all of the constructs that researchers would like to study, consequently, many researchers develop their own procedures. For example, Rourke and Anderson (2004) reported that when Garrison et al. (2000) adopted their theoretical model for critical thinking in an empirical study, they were unable to find any evidence of 'resolution' when they coded one-third of the transcripts as 'other', and coded the remaining two-thirds as 'exploration' and 'integration'. This led to the development of the *Practical Inquiry* model (*PI* model) Garrison et al. (2001). Content Analysis was used to investigate 'messages' as unit of analysis in the *PI* model.

In order to capture the complexities of online learning, Anderson, Rourke, Garrison and Archer (2001) adopted a previously developed model (see Figure 1 below). The quadrants of the model correspond to categories of *cognitive presence* indicators. In the model, there is also a possibility of *cognitive conflict* Piaget (1928), whereby cognitive development requires that individual encounter others who contradict their own intuitively derived ideas and notions. *Cognitive Presence* can be summarised as having four phases of critical thinking, namely, a *Triggered Event* deals with starting, inviting or soliciting a particular discussion; the *Exploration* phase is when information is exchanged between the learning participants; the *Integration* phase is when participant learners construct meaning and propose possible solutions; and finally, the *Resolution* phase is when proposed solution(s) is/are tested out (Garrison et al., 2001:11).

The method proposed by Garrison et al.'s (2001) for detecting *triggering events*, *exploration*, *integration* and *resolution* involved classification of the four categories at message-level. By message-level, we mean a unit of online transcript analysis that is objectively identifiable; unlike other units of online transcript analysis, the message-level unit allows multiple coders to agree consistently on the total number of cases Oriogun, Ravenscroft & Cook (2005).

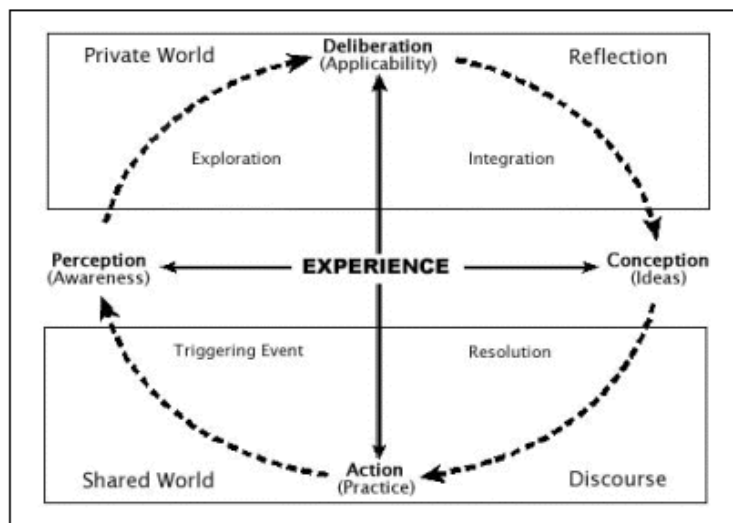


Figure 1. *Practical Inquiry Model* (Garrison et al. 2001)

### Introducing Fahy's TAT Alignments

Fahy et al.'s (2000) developed an analytical tool for measuring online transcripts, called *Transcript Analysis Tool* (TAT) based on Zhu's (1996) earlier work, which operates at a *sentence-level* of analysis for the comparison of the frequencies and proportions of 5 categories or sentence types in a particular dataset. After Fahy (2002) examined the *Practical Inquiry* model, he realised that the categories of the TAT might be capable of being aligned with the phases in Garrison et al.'s model, the resulting alignments reflecting different assumptions about the linguistic and social behaviour associated with the model's phases. From three such alignments an analysis was produced, allowing a comparison of both the analytic processes involved and the resulting richness of the insights provided. In aligning the TAT with the four phases of cognitive presence model (see Figure 1), interpretation was required. The TAT categories were produced, based upon different assumptions regarding what interactive behaviour is apparent in Garrison *et al's* (2001) phases of cognition (Fahy, 2002). Full detail on the TAT categories and alignments can be found in (Fahy, 2002) and (Oriogun, Ravenscroft and Cook, 2005).

### Literature Review of Inter-rater Reliability of CMC Content Analysis

Literature Review on the variables used for content analysis of online transcripts revealed that in the context of CMC research, five variables that tend to be investigated are participation, interaction, social, cognitive and meta-cognitive elements of online discourse. For example, Henri (1992) identified these five elements as key dimensions for the analysis of online discussion. She used *thematic* as a unit of analysis. Weiss and Morrison (1998) investigated critical thinking, understanding/correcting, misunderstanding and emotion using *thematic* and *message* as units of analysis. McDonald (1998) used *thematic* as a unit of analysis during the investigation of six variables, namely, participation, interaction, group development, social, cognitive and meta-cognitive elements. Hara, Bonk and Angeli (2000) used *paragraph* as a unit of analysis for the same five variables as Henri (1992). Fahy et al. (2000) investigated interaction, participation and critical thinking, using *sentence* as a unit of analysis. Oriogun (2003a) used *message* as a unit of analysis when he investigated participation and interaction when he first proposed his Transcript Reliability Cleaning Percentage (TRCP). The theoretical basis for the TRCP inter-rater reliability method was published recently (Oriogun and Cook, 2003).

## The SQUAD Framework

According to Oriogun (2003b), the SQUAD framework to CMC discourse adopts problem-based learning (Barrows, 1996; Bridges, 1992; Oriogun et al, 2002) as an instructional method with the goal of solving real problems by:

- Creating the atmosphere that will motivate students to learn in a group setting online (where students are able to *trigger* a discussion within their respective groups);
- Promoting group interactions and participation over the problem to be solved by the group online (where students can *explore* various possibilities within the group by actively contributing to the group);
- Helping learners to build up knowledge base of relevant facts about the problem to be solved online (where students can begin to *integrate* their ideas to influence others within their group);
- The newly acquired knowledge is shared by the group online with the aim of solving the given problem collaboratively and collectively (where students can *resolve* issues relating to the assigned work to be completed collectively);
- Delivering various artefacts leading to a solution or a number of solutions to the problem to be solved online (where students can *integrate* and *resolve* the problem to be solved collectively).

Garrison, Anderson, and Archer's (2001) definition and use of *trigger*, *exploration*, *integration*, and *resolution* within their *Practical Inquiry* model is in line with SQUAD approach usage of these same terms. We have empirically validated the SQUAD approach at message level with an established framework called the *Practical Inquiry* model for assessing cognitive presence of CMC discourse (Oriogun, Ravenscroft and Cook, 2005). We adopted the alignments suggested by one of the developers of the Transcript Analysis Tool (Fahy, 2002) at sentence level to assess students' cognitive engagement within online groups. The SQUAD is a semi-structured way of categorising online messages. The SQUAD approach to CMC discourse invites students to post messages based on five given categories, namely, *Suggestion*, *Question*, *Unclassified*, *Answer* and *Delivery* (Oriogun, 2003b).

## The Study

The case study used to validate the TRCP inter-rater reliability method is from a course titled Software Engineering for Computer Science that the author teaches at London Metropolitan University. In the first academic semester of 2005–06, 23 students completed the course.

**Table 1**  
**Group2 SQUAD Statistics**  
**(Group and Individual SQUAD Contribution) Semester 1 -2005/06**

<b>Student No</b>	<b>S</b>	<b>Q</b>	<b>U</b>	<b>A</b>	<b>D</b>	<b>TOTAL</b>
Student 1	27	7	4	9	12	59
Student 2	14	6	4	6	8	38
Student 3	6	0	1	4	5	16
Student 4	3	3	2	2	2	12
Student 5	8	1	0	2	6	17
<b>TOTAL</b>	<b>58</b>	<b>17</b>	<b>11</b>	<b>23</b>	<b>33</b>	<b>142</b>

The students were split randomly into 4 coursework groups (Groups 1-4). Groups 1 and 2 consist of 5 members each, Groups 3 had 6 members and Group 4 was composed of 7 members. Each group had a designated Tutorial Assistant (TA). Each group negotiated their software requirements online using the SQUAD software prototype (Oriogun and Ramsay, 2005) to facilitate their online contributions over a period of 12 weeks comprising the semester.

The author randomly selected Group 2 SQUAD statistics as a case study for the purpose of this experiment. Table 1 shows the final SQUAD statistics for Group 2 at the end of the semester. The associated online learning levels of engagement (Oriogun, 2003b) of each student is shown in Table 2:

**Table 2**  
**Group 2 SQUAD Online Learning Levels of Engagement**

Student	High (%)	Nominal (%)	Low (%)
Student 1	66	15	18
Student 2	57	15	26
Student 3	68	25	6
Student 4	41	16	41
Student 5	82	11	5

The purpose of this study is to use the TRCP inter-rater reliability method to clean a group of software engineering students' online transcripts before measuring their levels of engagement with respect to *participation* and *interaction*. Once this has been established, the author will then use SQUAD results applying TAT alignments as proposed by (Oriogun, Ravenscroft and Cook 2005, pp205-210) to measure the same group's online group engagement using the phases of the *Practical Inquiry* model as a framework. In the first semester of 2005/06, five students were asked to be second coders (or raters) of their own individual transcripts using data generated through the statistics compiled from the SQUAD software environment (see Table 1). It is expected that results obtained from such content analysis should be consistent with the students' online learning levels of engagement for each student as shown in Table 2.

**Table 3**  
**Coding Decisions Based on Message Ratings**  
**(Oriogun, 2003a; Oriogun and Cook, 2003)**

Coding Decision (Category)	Rating
No engagement with the group	0
Agreeing with others without reasons	1
Agreeing with others with reasons	2
Referring the group to relevant Web sites	3
Resolving conflicts within the group	4
Taking a lead role in discussion	5
Offering to deliver artifact(s)	6
Offering alternative solutions to group problems	7
Active engagement with the group	8

The group chosen for this study posted 142 messages among its five students from 12<sup>th</sup> October 2005 until 11<sup>th</sup> January 2006 (92 days). The author extracted all the messages from this group in order to investigate the quality of each student’s *participation* and *interaction* using *message* (Marttunen 1997, 1998; Ahern, Peck, and Laycock 1992) as a unit of analysis, where each message is objectively identified before producing a manageable set of cases that incorporates problem-based learning (Woods 2000; Oriogun et al., 2002) activities before categorization as documented in Table 3. It took a total of 5hours 45minutes to print the 142 transcripts and generate the initial TRCP values for all the transcripts as shown in Table 4. This exercise was conducted between 8<sup>th</sup> February 2006 and 15<sup>th</sup> February 2006 inclusive.

**The TRCP Approach**

After carefully reading each of the 142 messages, the author coded them (see Table 4 for the ‘unclean’ transcripts) using the criteria set out in Table 3. Each student was then rated according to the two variables being investigated, namely, *participation* and *integration* (see Table 5 for detail). Each student was asked to rate his or her own individual transcripts, generated when they used the SQUAD approach to negotiate software requirements online as a group in the first semester of 2005/06 (see Table 1).

**Table 4**  
**Coded Online Message Transcripts with Initial TRCP Values**

<b>Student 1</b> Initial TRCP = 56	<b>Student 2</b> Initial TRCP = 47	<b>Student 3</b> Initial TRCP = 13	<b>Student 4</b> Initial TRCP =8	<b>Student 5</b> Initial TRCP=47
5,5,5,	8,5,5,	0,6,5,	0,8,0,	0,6,8,
7,7,8,	4,6,5,	0,6,6,	4,5,5,	5,6,5,
6,8,8,	7,8,6,	4,5,6,	5,4,0,	7,6,5,
5,8,7,	8,5,6,	6,6,6,	4,0,6.	5,6,5,
5,8,8,	5,5,8,	6,7,4,		6,6,5,
8,5,8,	8,8,5,	6.		6,6.
5,8,6,	5,6,5,			
5,6,5,	7,6,7,			
5,6,5,	6,6,6,			
6,5,5,	4,8,6,			
7,5,8,	7,7,6,			
5,5,7,	5,4,7,			
5,8,7,	8,8.			
7,7,7,				
7,7,5,				
7,6,6,				
5,5,6,				
2,8,6,				
6,8,8,				
2, 5.				
<b>Total = 59</b>	<b>Total = 38</b>	<b>Total = 16</b>	<b>Total = 12</b>	<b>Total = 17</b>
<b>Rating = 6</b>	<b>Rating = 6</b>	<b>Rating = 5</b>	<b>Rating = 3</b>	<b>Rating = 6</b>



The student coders (raters) also had access to the details in Table 3, as well as their individual transcripts from Table 1. Each student coder (rater) sought clarification from the author with respect to the rationale behind the categories of message ratings, and to fully understand his intention before generating their own set of ratings.

**Table 5**  
**Category of Final Student's Rating and Variables Investigated**  
(Oriogun and Cook, 2003)

Variables Investigated	Unit of Analysis (Message)	Final Rating Category*
None	No engagement with the group	LLE
Participation, Interaction	Agreeing with others without reasons	LLE
Participation, Interaction	Agreeing with others with reasons	LLE
Participation, Interaction	Referring the group to relevant Web sites	MLE
Participation, Interaction	Resolving conflicts within the group	MLE
Participation, Interaction	Taking a lead role in discussion	MLE
Participation, Interaction	Offering to deliver artefact(s)	HLE
Participation, Interaction	Offering alternative solutions to group problems	HLE
Participation, Interaction	Active engagement with the group	HLE

\* MLE = Low Level Engagement, LLE = Medium Level Engagement, HLE = High Level Engagement

It was not the duty of the student coders (raters) to convince the author to change his mind about the coding decisions. Once the student coders (raters) were satisfied that they understood the intentions behind each coding decision in Table 3, they rated the transcript independently, and eventually built their own compilation of ratings before the final TRCP was calculated (see Table 6).

### Inter-rater Reliability Measure

Holsti (1969) provided the simplest and most common method of reporting inter-rater reliability—coefficient of reliability (C.R.)—as a percentage agreement statistic. The formula is

$$\text{C.R.} = 2m / n_1 - n_2$$

where:  $m$  = the number of coding decisions upon which the two coders agree

$n_1$  = number of coding decisions made by rater 1

$n_2$  = number of coding decisions made by rater 2

Cohen's kappa (1960), on the other hand, is a statistic that assesses inter-judge agreement for nominally coded data. It can be applied at both the global level (i.e., for the coding system as a whole) and the local level (i.e., for individual categories). In either case, the formula is

$$\text{kappa} = (F_0 - F_C) / (N - F_C)$$

where:  $N$  = the total number of judgements made by each coder

$F_0$  = the number of judgements on which the coders agree

$F_C$  = the number of judgements for which agreement is expected by chance

A number of statisticians characterize inter-judge agreement as inadequate, as it does not account for chance agreement among raters (Capozzoli, McSweeney, and Sinha 1999). Therefore, with respect to Cohen's kappa (1960), Capozzoli, McSweeney, and Sinha suggest that:

... values greater than 0.75 or so may be taken to represent excellent agreement beyond chance, values below 0.40 or so may be taken to represent poor agreement beyond chance, and values between 0.40 and 0.75 may be taken to represent fair to good agreement beyond chance.(6)

**Cleaning the Transcripts**

In line with Capozzoli, McSweeney, and Sinha suggestion (Oriogun and Cook, 2003; pp227-228) further suggest that:

“...if the initial percentage agreement is greater than or equal to 70%, the transcript is deemed to be “clean.” In this case, the initial TRCP was the same as the final TRCP. Otherwise, a final TRCP should be calculated before the transcript can be considered to be “clean” and adequate given the subjectivity of such scoring criteria. The kappa value (Cohen 1960) should be calculated from the clean transcript with a final TRCP.”

**Table 6  
Coded Online Message Transcripts with Final TRCP Values**

<b>Student 1</b> Final TRCP =100 Kappa = 1.0 F <sub>0</sub> = 59 F <sub>C</sub> = 18 N = 59	<b>Student 2</b> Final TRCP =100 Kappa =1.0 F <sub>0</sub> = 38 F <sub>C</sub> = 16 N = 38	<b>Student 3</b> Final TRCP =100 Kappa =1.0 F <sub>0</sub> = 16 F <sub>C</sub> = 7 N = 16	<b>Student 4</b> Final TRCP=100 Kappa = 1.0 F <sub>0</sub> = 12 F <sub>C</sub> = 11 N = 12	<b>Student 5</b> Final TRCP=100 Kappa = 1.0 F <sub>0</sub> = 17 F <sub>C</sub> = 8 N = 17
5,5,5,	5,5,5,	0,6,8,	0,5,8,	8,6,8,
4,7,8,	4,4,8,	2,6,4,	8,6,6,	5,6,7,
6,6,5,	5,8,8,	8,5,6,	8,5,8,	3,6,6,
5,8,5,	8,5,8,	6,7,6,	5,8,6,	5,6,6,
5,8,8,	5,5,8,	6,4,4,		8,6,8,
8,8,5,	8,8,5,	8,		6,6,
5,5,6,	5,6,8,			
5,6,4,	6,5,7,			
5,6,5,	6,6,6,			
6,5,5,	8,6,6,			
5,5,2,	7,5,6,			
5,5,5,	8,8,8,			
5,5,7,	8,8,			
7,7,7,				
2,5,5,				
6,6,6,				
5,5,6,				
1,8,6,				
6,8,6,				
1, 5,				
<b>Total = 59</b>	<b>Total = 38</b>	<b>Total = 16</b>	<b>Total = 12</b>	<b>Total = 17</b>
<b>Rating = 6</b>	<b>Rating = 6</b>	<b>Rating = 5</b>	<b>Rating = 6</b>	<b>Rating = 6</b>

The author invited the five students to the university on 17<sup>th</sup> February 2006 in order for each of them to rate their own transcripts before he calculated the initial TRCP values as shown in Table 4. Currently, Table 4 contains ‘unclean’ transcripts (Oriogun and Cook 2003, pp226-227). The author supplied the students with the coding decisions based on message ratings in Table 3, and told them that he has already used these categories to rate their SQUAD posted messages recently after they had completed their studies for the module, Software Engineering for Computer Science during the first semester of 2005/06.

The author further explained the rationale behind each coding decision, and asked the students not to confuse themselves while rating their own online transcripts by thinking of the SQUAD approach to online discourse. When he was happy that all the students understood the intentions behind the coding scheme in Table 3, they were asked to individually rate their own transcripts. It took a total of 2hours 55 minutes to finalise the rating of all 142 online message transcripts after discussion by the two raters (students acted as second raters of their own transcripts as shown in Table 1, the author acted as the first rater of each of the students transcripts) in order to generate the final TRCP value of 100, and a Kappa value of 1.0 for each student’s transcripts on 17<sup>th</sup> February 2006 as shown in Table 6.

Once the transcripts has been ‘cleaned’ using the TRCP inter-rater reliability method, the author used the phases of the *Practical Inquiry* model (triggers, exploration, integration and resolution) to realise the cognitive engagement of Group 2. Table 7 below shows the comparison of the phases of the *Practical Inquiry* model with the present Fahy (2005) *Practical Inquiry* / TAT results and Group 2 SQUAD results applying TAT alignments (Oriogun, Ravenscroft and Cook 2005, pp205-210). See the concluding section for the analysis of Table 7.

**Table 7**  
**Comparison of Phases of the Practical Inquiry Model With the Present Fahy (2005) Practical Inquiry/TAT Results and Group 2 SQUAD /TAT Alignments (Semester 1 –2005/06)**

Phases of the practical Inquiry Model	Practical Inquiry Model Results, Garrison, Anderson, and Archer (2001) Initial Pilot	Practical Inquiry Model Results, Fahy (2005) Present Study	TAT Results, Fahy (2005)	SQUAD Results Applying TAT Alignments SQUAD #1 Oriogun, Ravenscroft, and Cook (2005)	SQUAD Results Applying TAT Alignments SQUAD #2 Oriogun, Ravenscroft, and Cook (2005)	SQUAD Results Applying TAT Alignments SQUAD #3 Oriogun, Ravenscroft, and Cook (2005)
<b>Triggers</b>	<b>12.5</b>	<b>9.4</b>	<b>6.4</b>	<b>11.8</b>	<b>28.2</b>	<b>28.2</b>
<b>Exploration</b>	<b>62.5</b>	<b>74.2</b>	<b>76.4</b>	<b>48.6</b>	<b>7.7</b>	<b>48.6</b>
<b>Integration</b>	<b>18.8</b>	<b>14.6</b>	<b>14.6</b>	<b>57.0</b>	<b>64.1</b>	<b>64.1</b>
<b>Resolution</b>	<b>6.3</b>	<b>1.8</b>	<b>2.5</b>	<b>64.1</b>	<b>64.1</b>	<b>40.1</b>

### Interpretation of Results

It took Student 1 a total of 20 minutes to rate his own 59 messages (it took the author a total of 30 minutes to rate the same set of messages as depicted in Table 4 above). After Student 1 completed his rating, it took a further 30 minutes for both of us to agree on the final TRCP value of 100 in

Table 6 and to generate the final 'Rating' value of 6. In total, Student 1 online transcripts rating by both coders took a total of 40 minutes to finalise.

It took Student 2 a total of 25 minutes to rate his own 38 messages (it took the author a total of 22 minutes to rate the same set of messages as depicted in Table 4 above). After Student 2 completed his rating, it took a further 22 minutes for both of us to agree on the final TRCP value of 100 in Table 6 and to generate the final 'Rating' value of 6. In total, Student 2 online transcripts rating by both coders took a total of 47 minutes to finalise.

It took Student 3 a total of 13 minutes to rate his own 16 messages (it took the author a total of 4 minutes to rate the same set of messages as depicted in Table 4 above). After Student 3 completed his rating, it took a further 30 minutes for both of us to agree on the final TRCP value of 100 in Table 6 and to generate the final 'Rating' value of 5. In total, Student 3 online transcripts rating by both coders took a total of 43 minutes to finalise.

It took Student 4 a total 7 minutes to rate her own 12 messages (it took the author a total of 3 minutes to rate the same set of messages as depicted in Table 4 above). After Student 4 completed his rating, it took a further 9 minutes for both of us to agree on the final TRCP value of 100 in Table 6 and to generate the final 'Rating' value of 6. In total, Student 4 online transcripts rating by both coders took a total of 16 minutes to finalise.

It took Student 5 a total 7 minutes to rate his own 17 messages (it took the author a total of 5 minutes to rate the same set of messages as depicted in Table 4 above). After Student 5 completed his rating, it took a further 12 minutes for both of us to agree on the final TRCP value of 100 in Table 6 and to generate the final 'Rating' value of 6. In total, Student 5 online transcripts rating by both coders took a total of 19 minutes to finalise. Table 8 shows some of the actual messages sent by members of Group 2 under the S category of the SQUAD framework. See Appendix for these messages.

**Table 8**  
**Examples of Online Discourse for Final Transcript Reliability Cleaning Percentage (TRCP) Transcript**

Message Number	Student number	Final TRCP Rating
31	1	5
4	2	4
3	3	8
2	4	5
7	5	3

## Discussion

It took 5 hours and 45 minutes for the author to generate the initial 'unclean' TRCP transcripts. It took a further 2 hours 55 minutes to generate the final 'clean' TRCP transcripts and the associated TRCP value together with the Kappa value for comparison after discussion with each student involved in this study. In total, it therefore took 8 hours 40 minutes to complete this study. This is the reason why quantitative content analysis of computer transcripts is time consuming. In my previous study (Oriogun and Cook 2003; p230) it took 11 hours to finalise the coded transcripts by just two raters. This is the reason why few researchers using quantitative content analysis of computer transcripts have published results derived from a second content analysis.

TRCP inter-rater reliability method measures online *participation* and *interaction*. As the author is validating the TRCP method within the SQUAD framework (a semi-structure approach to online discourse), the expectation from this experiment was that the students would have participated and interacted within their group effectively. This has been borne out from this experiment. Although, the initial TRCP ratings for three of the students was ‘High Level Engagement’ (Student 1, Student 2 and student 5 all scored an initial TRCP of 6 with the unclean transcripts), one of the student’s (Student 3 score an initial TRCP of 5) rating was ‘Medium Level Engagement’, and finally, Student 4 scored the lowest as far as the unclean transcripts was concerned, making the students rating ‘Low Level Engagement’.

## Conclusion

The final TRCP ratings confirms that when using a semi-structured approach to online transcripts as a framework to calculating students’ online levels of engagement with respect to variables *participation* and *integration*, students engagement are expected to be relatively high. The author realised in the final ‘clean’ transcripts that indeed, four of the five students in this study had scored ‘High Level Engagement’ (namely, Student 1, Student 2, Student 4 and Student 5). Student 3 remains at ‘Medium Level Engagement’ (see Table 6).

The fact that these five students had worked under the SQUAD framework, a semi-structured approach to online discourse before this exercise, during the formulation of the final TRCP values, the students became the owner of their own transcripts, and were able to articulate the meaning and intentions behind each of their messages. This is in fact why in the final TRCP values for each of the students was indeed 100%.

In effect, the roles stipulated for first and second raters of the transcripts initially by the author has been reversed, indeed, during the discussion of the transcripts, the author found himself to be agreeing with all the students. Recently the author read an article on inter-rater reliability Wilson Cockburn and Halligan, P (1987), where authors of the article reported that 100% inter-rater reliability was achieved in their study. The author was rather surprised at this particular finding, however, the empirical study presented in this article appear to support their claim.

The *Practical Inquiry (PI)* model initial pilot results (Garrison, Anderson and Archer 2001), the present Fahy (2005) *PI* model results and Fahy (2005) current TAT results all indicate that *exploration* was clearly the most common type of posting. The TAT result and the initial *PI* model results showed that the next most common type of posting was integration. The SQUAD results however showed on average that *integration* was the most common posting, followed closely by *resolution*, this was followed by *exploration* and finally *triggers*. The reason for this could be because the SQUAD is already a semi-structured approach to online discourse, and students’ contribution was already scaffold during the semester. Indeed, this was why the students took ownership of their transcripts during the ‘cleaning’ of their individual transcripts, as they are already very much aware of their own messages and the meaning attached to the same. This also plays an important role in having achieved TRCP of 100% and Kappa value of 1.0 during the cleaning of each of the student’s transcripts.

It is also possible that because the *PI* model and the TAT alignments are still operating at the inter-rater reliability level of granularity, whilst the SQUAD approach operates at a slightly higher level of reasoning by already scaffolding software engineering students online postings, contribute to the better results exhibited by SQUAD in comparison to the *PI* model and the TAT alignments.

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## APPENDIX

### Messages Sent by Students

#### Student 1 Message 31

**S-Student 3(Normalization + Process Model) – Student 1**

**Sun Nov 20 11:02:00 GMT 2005**

Hi Student 3,

I saw your Normalization + Process model picture which are great. You need to change our ERD to reflect with your process model, which I find more complete.

However! I think you need to read just your normalisation. First we don't need customer details. One more, start with unnormalised set of data, then go to Normalisation 1 then 2 then you reach to level 3 which you have done..

Okie??

Before I forgot, please can you change the data in our zip database? What you need to change is in the Order Details table we have got Transaction date. Please can you change all 2003 into 2005 and keep the date and month.

Okie?

Cheers

#### Student 2 Message 4

**S-TASK 2 – Student 2**

**Wed Oct 19 13:39:54 BST 2005**

I've uploaded my work; sorry I didn't inform you all about not being in today. Not feeling well, happened overnight kinda thing, so apologies for not being there today at tutorial. I just quickly came on to send my work, its one part of it. The other 2 are a bit tricky.

Firstly, there's a bit about operational policies (policies on audit trails, copyright protection, etc), we haven't discussed that at all, so I have no idea what to put there.



Secondly, Operational stakeholders is very similar to effects of operations, since I'm basically writing the stakeholders involved, and how they interact etc, so I only had that under effects of operations.

And finally, redressal of current system shortfalls. We haven't talked about the proposed system, how it will be, what it will involve, so I don't know what to write for that. Only thing we know are the stakeholders. But we never went further than that to discuss how or what the proposed system would be like.

Ok, I think that's a lot of reading.. but basically, at the end of the day, we can't just keep going away like this and do tasks one after the other when the middle, or the end isn't clear. I don't know about the rest of you, but its like we're just trying to push along, without discussing how it's going to plan out at the end. Any comments would be appreciated.

### **Student 3 Message 3**

**S-Important reading about winwin – Student 3**

**Fri Oct 14 23:38:22 BST 2005**

have uploaded the file for everybody; please make sure read it carefully. Should know about win-win negotiation before going to next steps. Other files will uploading soon.

Regards

### **Student 4 Message 2**

**S-Left members of the group – Student 4**

**Fri Oct 21 12:15:20 BST 2005**

Hello all,

Some of us have already left the group and I don't know the name of them except Student X. Since we have to inform Peter how many people we need to replace asap, please post the name of the people who's left. I am sending emails to everyone in case those people who are already left won't see the SQUAD.

## **Student 5 Message 7**

### **S-Lab – Student 5**

**Wed Nov 09 05:51:45 GMT 2005**

Hey guys, I have a morning appointment 2day, which I unfortunately cannot reschedule, so I will not be able 2 make it to the lab 2day. If you guys can choose the features you decide to implement from the file I uploaded last week, I can finish work on the document. I will have the revised ERD up by tonite. Also, feel free to send me a task list of work, which we need to finish before the next meeting. Sorry once again.

Student 5

## **About the Author**



**Peter Oriogun**

**Peter Oriogun** is currently a Senior Lecturer in Software Engineering at London Metropolitan University. He is the Course Director of the MSc Computing programme offered by London Metropolitan University. His current research interests are in semi-structured approaches to online learning, CMC transcript analysis, software life cycle process models, problem-based learning in computing and cognitive engagement in online learning. He is a chartered member of the British Computer Society. He has over 20 years teaching experience in software engineering, computing and online collaborative learning within Further and Higher education institutions in the UK, and has extensive publication in this area of expertise. The title of his PhD thesis by prior output is “Towards understanding and improving the process of small group collaborative learning in software engineering education”.

Peter K Oriogun  
Department of Computing, Mathematics and Communications Technology  
London Metropolitan University  
166-220 Holloway Road  
London N7 8DB

Email: [p.Oriogun@londonmet.ac.uk](mailto:p.Oriogun@londonmet.ac.uk)

Tel: +44 0207 133 7065

**Editor's Note:** This research explores the relationship between esthetics, information elements and learning style preferences on learning and learner satisfaction. It reinforces existing research and praxis and provides new data for instructional designers and teachers to consider in the development of interactive multimedia and web-based learning.

## **Web-based Distance Learning Technology: Effects of instructor video on information recall and aesthetic ratings**

**Cristina Pomales-García and Yili Liu**

### **Abstract**

This research examines the impact of several aesthetic/appearance characteristics of web-based distance learning environments on information recall and perceived content difficulty. Six web-based instructional modules were used, which consisted of fragments of different lectures, each containing a different topic and ranging between three to six minutes in length. The results show that appearance/aesthetic judgments do matter and they offer additional insights into the effectiveness of instructional methods beyond traditional performance measures. The integration of aesthetic/appearance judgments in the evaluation of web-based distance learning technology gives us valuable insights to deepen our understanding of what characteristics of the educational technology make it more appealing and successful.

**Keywords:** distance education, web-based distance learning, distance learning technology, aesthetics, information recall, multimedia learning, cognition and affect, web modules.

### **Introduction**

In recent years, there has been an increasing interest in research on distance learning technology and distance education environments. Not only in the educational environment, but also in the literature distance learning has been explored. Bork (2000) looked at fictional accounts of the future of learning. He summarized the ideas from four novels written between 1950 and 1995 which projected the future of education as an environment where there are no schools the way we know them today. These stories also mentioned it was not necessary to have people gather at a central location for learning. In a way, these four novels are fictional predictions of the concept of distance learning, which is an option available in today's educational world. In the year 2000 almost 90 percent of all universities with more than 10,000 students offered some form of distance learning, nearly all of which used the internet (Svetcov, 2000).

Distance education is based on two general concepts: (1) it is a model of instruction; where (2) the learner and learning resources are separated by space and/or time. Keegan (1988, 1996:50) developed a comprehensive definition of distance education as a form of education characterized by:

- the quasi-permanent separation of teacher and learner throughout the length of the learning process;
- the influence of an educational organization both in the planning and preparation of learning materials and in the provision of student support services;
- the use of technical media (e.g., print, audio, video or computer) to unite teacher and learner and carry the content of the course;
- the provision of two-way communication so that the student may benefit from or even initiate dialogue; and

- the quasi-permanent absence of the learning group through the length of the learning process so that people are usually taught as individuals rather than in groups, with the possibility of occasional meetings, either face-to-face or by electronic means, for both didactic and socialization purposes.

Research in distance learning and education has been studied from two principal perspectives: technology-centered approach and learner-centered approach. The technology-centered approach is based on the functional capabilities of technology and asks questions from the standpoint of how those capabilities could be used for design purposes. The learner-centered approach takes into account the human mental capabilities and asks questions from the standpoint of how to create or adapt technologies to enhance learning (Mayer, 2001). The learner-centered approach is widely used because of a deeper understanding of the differences between the power of technology and the needs of the users, and a general recognition of users being the guiding force in the design. In today's higher education community, many colleges and universities are creating distance learning courses to keep up with the needs of the student population and with institutional goals of making education accessible to more people all over the world. Our research focuses on the learner-centered approach to understand not only what is specific within the distance learning environment modules is accounting for the learning outcomes but it also takes into account the user perspectives as the guiding force.

With respect to the design of educational technologies and education systems, there are many human factors and ergonomics challenges. When evaluating web-based distance learning (WBDL) environments, which are being used more frequently by students to review and supplement class materials, human factors issues should be taken into account. These issues have traditionally included ease of use, workload or information processing demand, and potential physiological effects of the interaction on the users. The evaluation of the appearance/ aesthetic domain is not usually incorporated (Liu 2003a, 2003b). For example, in terms of the design criteria for web-based instructions, Miller and Miller (2000) suggest several theoretical and practical considerations, but aesthetic factors were not taken into account as important variables in the design of web-based instruction. Studies in distance learning education and technology measure overall performance and satisfaction with the course but do not identify which design characteristics within the individual courses are specifically accounting for the differences. Questions are not asked from the standpoint of what are the specific delivery method or WBDL design variables that influence student satisfaction ratings and how to measure these variables. Few studies consider the appearance/aesthetic perceptual component as an important variable in education technology. In this article, we describe our human factors/learner-centered research on WBDL technologies, investigating both performance and aesthetic factors. The technology we evaluated is web-based instructional modules, which are defined as self-instructional units for independent study (Heinich, Molenda, & Russell, 1982, pp. 281).

## Literature Review

### *Distance Learning and Distance Education Research Approaches*

In the distance learning research environment the most common research approach is to compare student performance between different teaching modes alternatives and measure student satisfaction. This is done by comparing student satisfaction and performance between traditional classrooms and distance education environments. In an early study on the influence of participants' perception of aestheticism, evaluation, privacy, potency, and activity of a teleconferencing medium, Ryan (1976) found that both videoconferencing and face-to-face communication modes were perceived as more aesthetically positive than audio conferencing. However, both video and audio conferencing were perceived as more "potent" communication channels than face-to-face communication. The video and audio communication modes in Ryan's

(1976) study evoked in the participants a greater sense of social distance and formality (very common reactions to communication technology), even though they represented a somewhat narrower signal (stimulus) bandwidth than face-to-face communication. This study was able to determine and measure aesthetic characteristics or preferences of a sample to a communications medium but did not look at the influences between communication mode and its impacts on learning.

Allen, et al. (2002), conducted a meta-analysis study on research articles related to “distance learning,” “distance education”, and “satisfaction” with a distance education course and a course using traditional face-to-face methods of instruction. For the meta-analysis, a hierarchy of three types of distance learning or distance education formats was considered (media channels): writing, audio, and video. The concept of hierarchy states that audio education would include written information provided to and from the student, and that video education will, in addition, use audio and written materials. In this hierarchical scheme, it is assumed that the more complex media channel also utilizes the lower channels along with the more complex source of information. The assumption behind this idea is that students will demonstrate higher levels of satisfaction with channels that contain more information. This is called by Mayer (2001) the learning-preferences hypothesis, according to which different people learn in different ways, so it is best to present information in many different formats. For example, if face-to-face/traditional instruction is rated highest in satisfaction, then as each channel is removed, the expectation would be that the level of satisfaction would decrease with the alternative technology, indicating that it is the amount of information that is connected to the level of satisfaction. Would this hypothesis apply to distance education technologies when using a computer as the instructional medium?

The results from the meta-analysis (Allen, et al. 2002) showed that students indicate a slightly higher level of satisfaction with live course (face-to-face) setting than distance education formats based on a sample of 25 studies. The effect size comparison for the video channel in a sample of 23 studies, indicated a very small correlation favoring distance education. But when the video channel analysis is conducted excluding two relevant outliers the analysis is changed to favor slightly the traditional education. The comparison of videotaped instruction to the written communication format indicated that as the information in the channel is reduced, students indicate a preference for video over the written instruction. This is consistent with the author’s hypothesis stating that the ability to get more information, including visualization of the instructor, is a preferred method of instruction over more restricted channels.

Overall, the authors in this meta-analysis study concluded that the objections to distance education should not be based on the issues related to student satisfaction since students find distance learning as satisfactory as traditional classroom learning formats. This meta-analysis focuses on the impact of instructional format on satisfaction but disregards the learning aspects and the impacts of aesthetic variables between the different modes of instructions. Why only focus on which format is best, if ultimately the interest relies not only on satisfaction and acceptance but on the learning impacts of the different technologies? It is entirely possible that the students, while equally satisfied with distance education, do not learn as much as they would learn with the methods involving traditional face-to-face communication in a traditional classroom. Satisfaction with the educational process provides only one possible source of evaluation and must be compared to other evaluations of the effectiveness and value of any pedagogical device or procedure.

A meta-analysis by Machtmes and Asher (2000) across 19 studies in adult and higher education found little difference in learner achievement, measured through test scores, between the traditional face-to-face communication and distance learning. Among all the instructional features analyzed in this meta-analysis only the type of interaction available during the broadcast, type of course and type of remote site, had an impact on student achievement, which was coded as test

scores on pretest/posttest, midterm or final exam. These findings provide evidence that distance learning may offer as much academic improvement as traditional learning environments.

In a study by Rutz, et al. (2003) on student performance and acceptance of instructional technology, the authors compare traditional and technology-enhanced instruction with a course about Engineering Mechanics. The technology-enhanced instruction in this study was defined as an interactive video class, web-assisted class or a streaming media class.

- In an interactive video class the students are in a remote classroom and could see and hear the instructor in real time, and the instructor could see and hear students from the remote site.
- Web-assisted classes were structured so that the student reviewed the content for a particular lesson on the web and came to an in-person class session prepared to discuss the content. These web classes contained text, graphic images, links to related topics and downloadable material. Using this format, the students were able to view Power Point presentations, example problems, solutions to homework and test problems prepared by the instructor.
- The streaming media class was structured with the same objectives of the web-assisted class. Students were able to access a web page that contained audio, video and images on the whiteboard which recreated the classroom experience in an on-line delivery format.

This study defined performance as the mean course grade for each instructional format averaged over the two years of the study. The results for performance analysis showed significantly higher differences between each of the three technology enhanced instruction modes when compared to the traditional lecture format but no significant differences between the technology-enhanced formats. Satisfaction was measured as (1) student perception of learning effectiveness for a particular instructional format, (2) effectiveness of technology-enhanced instructional format compared to traditional classroom, (3) likelihood of the student enrollment in technology-enhanced class, if given the opportunity, than to enrolling a traditional class, and (4) perceived effectiveness of the instructor. In the analysis of the satisfaction criteria the results showed that students did not feel that the technology-enhanced instructional formats were more effective than the traditional classroom setting, except for the web assisted course.

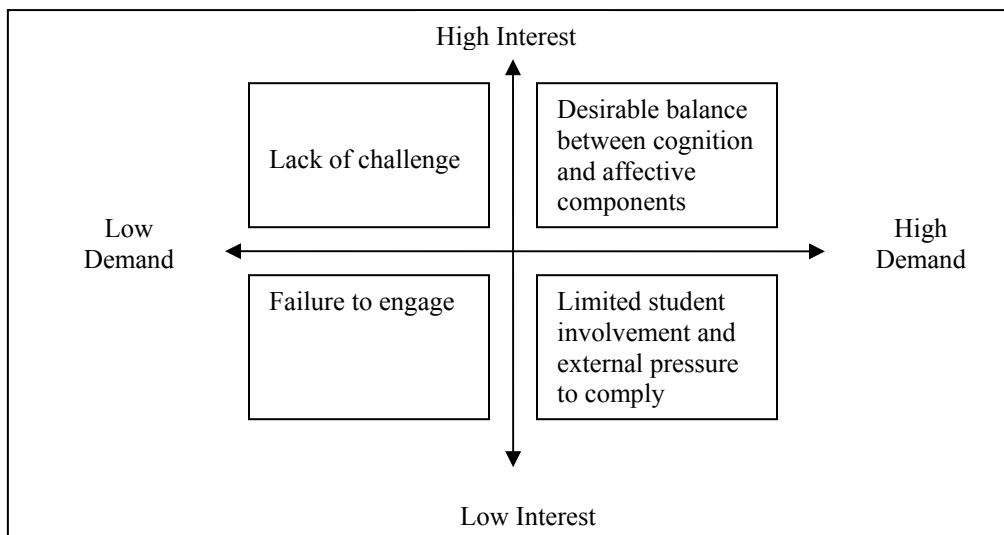
In terms of design criteria, when designing web-based instructions, Miller and Miller (2000) suggest several theoretical and practical considerations: (1) the features of the web environment relevant to instruction (e.g., structure, media, and communication capabilities); (2) factors that influence the design of web-based instruction (e.g., theoretical orientation, learning goals, content, learner characteristics, and technological capabilities); (3) issues for web course developers to consider as they design web-based instruction (e.g., literature review, level of technological expertise, learning goals for the course, nature of course content, learner characteristics, acquire technological expertise, adopt effective instructional theories and techniques); and (4) factors that will affect the future of web-based instruction (e.g., efficacy studies, technological advances, pressures of competition and cost containment, and professional responses to market influences). In this set of practical and theoretical considerations for designing web-based environments, aesthetic factors are not taken into account as important variables in the design of web-based instruction.

In 1997, Boshier et al. suggested that attractive instructional features are a key consideration in success of an effective online course. This group, at the University of British Columbia, evaluated 127 courses taken over the Internet and found that the aesthetic standards of an online course can be as important as the content and skills it is expected to convey. In this research they “paid attention to the feeling and tone of the course, not just the content and teaching process...as the

appearance "can make or break" an online course...and additional research is necessary in this area, however, it is safe to say, we must pay attention to the visual appeal and "feel" of our course if we expect to maximize student learning online." (Boshier et al., 1997).

### ***Cognition and Affect***

A study by Baird, Gunstone, Penna, Fensham, and White (1990) explored how various features of classroom context influenced teaching and learning processes. They used individual and group interviews, class discussions, written evaluations and participant observations as their data collection methods. Nine major features of a teaching/learning event were found to interact and influence the cognitive and affective component of challenge. The features or events of teaching/learning environments include perception of amount of work, difficulty of work, importance of the work, relevance of the work, novelty or variety of the activities, extent of individual control over the process, opportunity for active involvement, interpersonal features of the teaching/learning context, and physical features of the teaching/learning context. The authors define challenge as comprising two main components: a cognitive/metacognitive demand component and an affective interest and enjoyment component. Figure 1 shows a representation of the relationship between cognitive demand and affective interest, and how the teaching/learning environment is affected by both.



**Figure 1. Representation of the relationship between cognitive demand and affective interest (Baird, Gunstone, Penna, Fensham, and White, 1990)**

The authors propose that there are different levels of challenge that result from the interaction between interest and demand. These findings suggest that there is a relationship between affect, which we call aesthetics/appeal, and cognitive demand in traditional classrooms. Would the same relationship hold for web-based distance learning (WBDL) environments? Will difficulty of module content have any impact or interaction with the appearance variables? What would happen to the rating of appearance of a module if it is perceived as difficult? In our study perception of module content difficulty is measured to investigate its relationship with appearance characteristics.

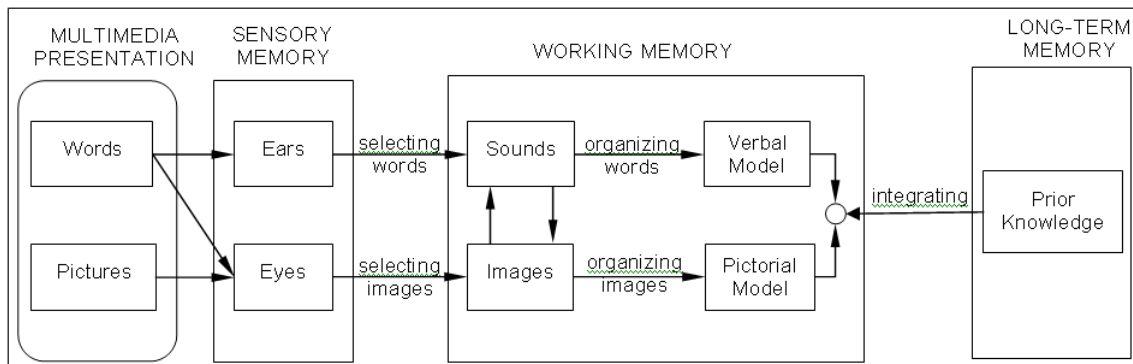
### ***Multimedia Learning***

Multimedia is one of the most common terms used when referring to educational technology and distance learning. As defined by Mayer (2001), multimedia is the presentation of material using both words and pictures. Words in verbal form such as using printed or spoken text, and pictures when the material is presented in pictorial form such as using static graphics, including illustrations, graphs, photos or maps or using dynamic graphics, including animation or video. According to this definition WBDL modules, which contain a combination of audio, video, Power Point slides of text and pictures would be considered multimedia.

The Cognitive theory of Multimedia Learning, developed by Mayer (2001), rests on three basic assumptions about the human information processing system:

1. Humans possess separate channels for processing visual and auditory information (Paivio, 1986; Baddeley, 1992)
2. Humans are limited in the amount of information that they can process in each channel at one time ( Baddeley, 1992; Chandler & Sweller, 1991)
3. Humans engage in active learning by attending to relevant incoming information, organizing selected information into coherent mental representations and integrating mental representations with other knowledge. ( Mayer, 1999; Wittrock, 1989)

In the multimedia learning model (Figure 2) the arrows represent the steps of processing involved in the cognitive theory of multimedia learning: (1)selecting relevant words, (2)selecting relevant images, (3)organizing selected words, (4)organizing selected images, and (5)integrating verbal and visual representation as well as prior knowledge.



**Figure 2. Visual representation of the Cognitive Theory of Multimedia Learning (Mayer, 2001)**

This model predicts that when pictures (e.g., animation), spoken words (e.g., narration) and written words (e.g., text) are simultaneously presented in multimedia presentations, the visual channel will become overloaded. According to Mayer, this can happen in two ways, first, pictures and written words compete for limited cognitive resources in the visual channel because both enter the information processing through the eyes. Second, when verbal information is presented both visually and auditorily, learners may be tempted to attend to both in an attempt to reconcile the two information streams; this according to Mayer, requires cognitive resources that consequently are not available for processing the animation and mentally linking it with the narration. Mayer states that this theory predicts a redundancy effect in which adding on-screen text to a concise narrated animation will result in poorer learning as indicated by results of retention tests and in poorer understanding, as indicated by the results of transfer tests. Mayer uses the term redundancy to refer to any multimedia situation in which learning from animation (or illustrations) is superior to learning from the same materials long with printed text that



matches the narration. What would happen when only spoken words and written words are used simultaneously, as in narrated text? Would the redundancy principle apply to a WBDL material which contains a video with audio of a professor teaching a class, and power point presentation of the material the professor is discussing? The material presented in power point includes pictures, graphs and/or text. The class segments used in the experiment as test material consist of different topics, but they are considered to be similar because they have the same professor, classroom and presentation style.

### ***The Present Research***

Many of the reviewed articles on distance education only focus on which type of format is best, comparing distance education to traditional face-to-face instruction (Allen et al., 2002; Ryan, 1976; Machtmes and Asher, 2000; and Rutz, et al., 2003). It is important to understand whether differences exist in student satisfaction between the instructional methods, but ultimately the interest relies not only on satisfaction and acceptance but on the impacts of the different technologies. We need to understand what affects student satisfaction directly and whether the design characteristics of distance learning environments are related to students' judgments and performance.

We recognize the importance of environmental variables in WBDL modules as well as the value of evaluating the impact of aesthetic and affective dimension in the design and development of these environments. From the literature review (Boshier, et al., 1997) we see a need for a study that integrates the impact of WBDL characteristics on aesthetic preference variables and learning. Our first step in this study was to take the learner-centered approach (Mayer, 2001) to understand which WBDL environment characteristics may impact information recall and appearance judgments. On the basis of this work we further evaluated the impact of video on WBDL aesthetic judgments, (measured as perceived attractiveness, preference, and excitement), information recall (measured as number of phrases and keywords recalled), and perceived content difficulty with a sample of college of engineering undergraduate students.

In this paper we describe an experiment in which the following questions were addressed:

1. What is the relationship between the use of video in WBDL modules and retention of material as measured by phrase and keyword recall?
2. Which is the impact of instructor video on appearance judgments as measured by perceived attractiveness, preference and excitement?
3. What is the relationship between perceived difficulty, module type, information recall, and appearance judgments?

There are two main hypotheses behind this work: (1) The learning preference hypothesis suggests that as more media channels are included satisfaction will increase. According to this we hypothesized that there would be a difference in aesthetic appeal (module preference, excitement and attractiveness) for web modules presented with or without video. (2) Retention of information, measured by recall of phrases and keywords, in modules without video should be better than recall in modules with video, according to the cognitive theory of multimedia learning and the redundancy principle unless the video does not overload the visual channel.

### **Methods**

An experiment was designed and conducted to evaluate the effects of web-module video on information recall, perception of content difficulty, and perceived appearance/aesthetic ratings. Six web-modules were used, consisting of 3 to 6 minute fragments of different lectures, each containing a different topic. Information recall was measured by the number of correct phrases

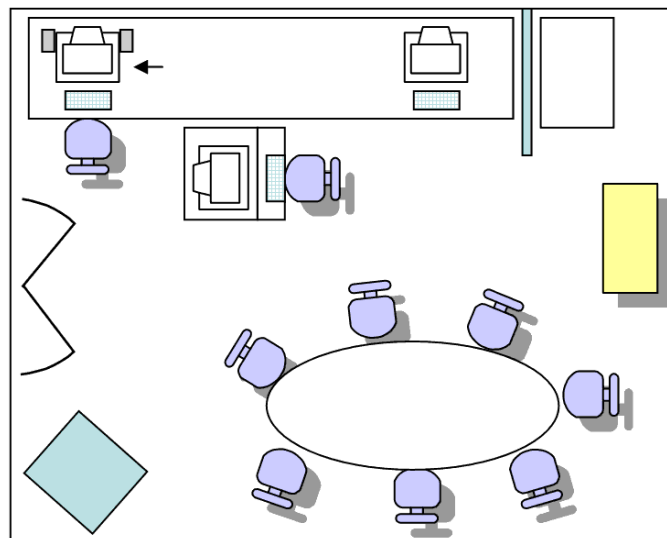
that the participants were able to recall during a 2 minute interval immediately after the web-module presentation, and the total number of keywords that the participants used to compose the phrases. The phrases were checked against a transcription of the different modules. Aesthetic response was measured by the participants' ratings of perceived preference, attractiveness and excitement of each web-module.

### ***Participants***

Sixteen undergraduate students between the ages of 18-21 years (8 females and 8 males), enrolled at the University of Michigan, College of Engineering, Ann Arbor, participated voluntarily in this experiment. All the participants were paid \$15.00 each for their participation, completion of the experiment and following instructions.

### ***Equipment and Materials***

The experiment was conducted in the Usability Laboratory at the Duderstadt Center at the University of Michigan, Ann Arbor (see Figure 3 for the lab room setup). Two IBM computers were used in this experiment. Both computers had installed VNC viewer remote access software version 4.0 and Real Player version 10. The participant station consisted of an IBM Computer running Windows XP with a screen resolution of 1024x768pixels, speakers, mouse and keyboard. The mouse and keyboard were not used by the participants during the experiment but were provided to make the environment more realistic. The participants used the speakers to adjust the volume intensity of the different sounds played by the computer for each web-module. The experimenter station had an IBM computer running in Windows 98. The experimenter used the VNC program to connect to the participant's computer, set up, and play the different web-modules that were evaluated during the experiment.



**Figure 3. Configuration of the Usability Laboratory used for the experiment.**

### ***Web-Modules***

Fragments of six lectures on Environmental Impact Assessment were selected on the following topics: Ground Water Contamination (4:38 min); Air Pollution Meteorology (6:34 min); Model Evaluation (6:17 min); Basis of Diffusion (6:16 min); Water Cycle (6:39 min); and Mixing Heights (3:14 min). This set of modules were presented to the participants with or without the instructor video using an Internet Explorer browser. Both types of modules included the instructor audio, audio/play controls and table of contents, the school heading, course slides, and copyright

information, as shown in Figures 4. The table of contents within the web-module contained the course number and title, instructor name, module topic and a list of the slides contained in the module.

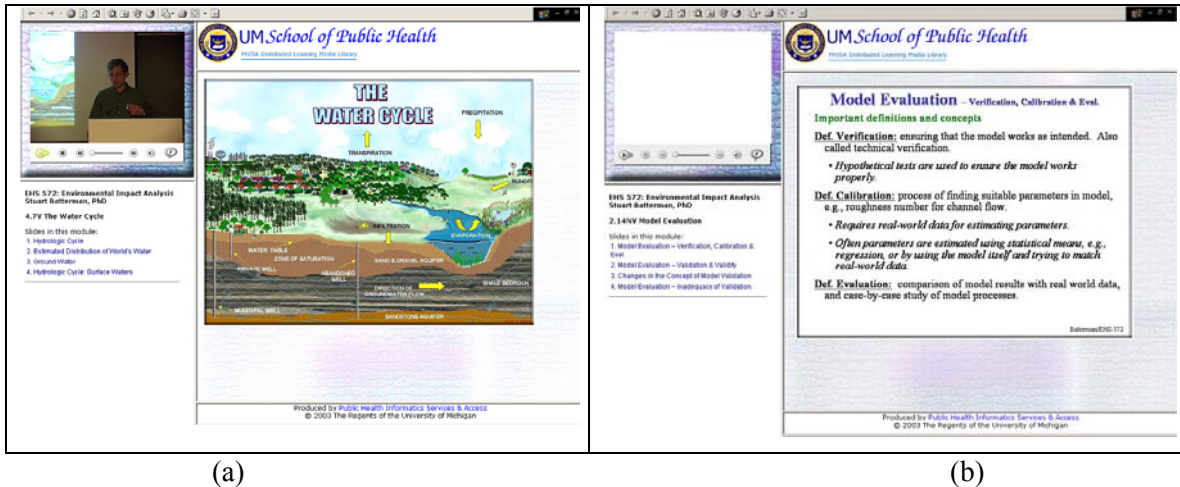


Figure 4. Examples of web modules with video (a) or without video (b).

## Procedure

The participants were greeted and escorted to the Usability Laboratory at the University of Michigan, Duderstadt Center. Once in the laboratory the participants were asked to sit in the chair provided in the assigned computer station, read and sign a consent form if they agreed to it. The experimenter then proceeded to load and play the first module on the participant's computer with the VNC viewer program operated from the experimenter station. The participant was given the opportunity to adjust the volume of the computer speakers at any time and was not allowed to take notes. Once the module finished playing and stopped, the experimenter closed the module window on the participant's computer screen. The participant was then handed a sheet of paper and asked to "write in two minutes as much as you can about what you heard or learned from the web-module you just saw". After the two minute period, the participant was asked to wrap-up the writing and hand back the sheet. The participant was then given a second sheet with questions on general content and appearance. The participant was asked to mark his/her response with an X on a visual analog scale ranged between 0-10. In the content question the participant was asked the following:

1. Please rate with an **X**, the *level of difficulty* that this web-module presented, 0 being least difficult (simple) and 10 being most difficult.

Three additional questions on general appearance used the same visual analog scale. The participant was instructed to answer these questions without considering the content of the web-module. The general appearance questions read as follows:

- Please rate with an **X**, your *preference* for the web-module you just viewed, 0 being least preferred and 10 being most preferred.
- Please rate with an **X**, how *attractive* is this web-module you just viewed, 0 being the most displeasing or unattractive and 10 being the most pleasing or attractive.
- Please rate with an **X**, how *exciting* is this web-module you just viewed, 0 being the most sleep producing/boring and 10 being the most exciting.

Once the participant finished answering the content and appearance questions the experimenter loaded the next web-module to be played on the participant station, by clicking on a menu and maximizing the corresponding window to full screen. This procedure was repeated for each of the modules presented for a total of 6 trials. For analysis purposes, the first two modules were considered practice trials and the participants were informed the first two trials were practice and how many modules they were going to see. A 4\*4 Latin-Square matrix was used to randomize and counterbalance the trials. Details for the Latin-Square matrix are shown in Tables 1 and 2.

**Table 1**  
**The 4\*4 Latin Square Matrix for participants 1-4**  
**and counterbalanced order for participants 5-8 with practice trials.**

Participant Number	Gender	Trials					
		Practice		Experimental			
		1	2	3	4	5	6
1,9	M	E	F'	A	B'	C'	D
2,10	M	E	F'	B'	C'	D	A
3,11	F	E	F'	C'	D	A	B'
4,12	F	E	F'	D	A	B'	C'
5,13	M	F'	E	D'	C	B	A'
6,14	M	F'	E	A'	D'	C	B
7,15	F	F'	E	B	A'	D'	C
8,16	F	F'	E	C	B	A'	D'

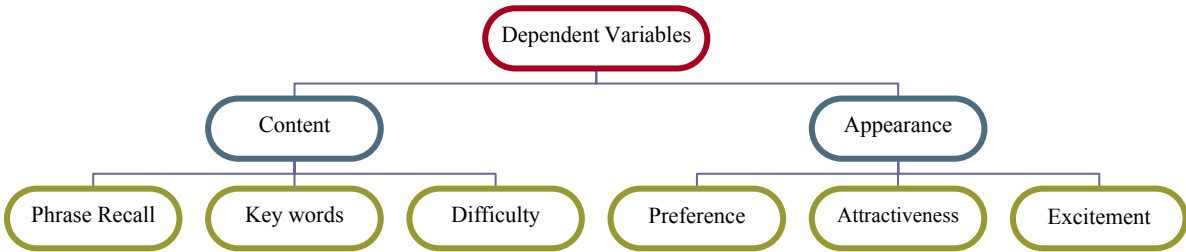
**Table 2**  
**Assignment of web-modules to Latin-Square variables**  
**and coding used to identify the variables.**

	Lesson	Module Type
A	Model evaluation	video
A'		audio
B	Basis of diffusion	video
B'		audio
C	Water Cycle	video
C'		audio
D	Mixing Heights-Atmosphere	video
D'		audio
E	Ground Water contamination	video
F'	Air pollution meteorology	audio

**Data Analysis**

Six dependent variables were measured, including three content variables and three appearance variables. The content variables were: information recall and perceived difficulty of the web-module material.

Information recall was measured in two ways: (1) the number of correct phrases or sentences that the participants were able to write during the two minute interval after the web-module presentation; and (2) the total number of keywords that the participants used to compose the recalled phrases. The keywords were selected by identifying those words (nouns or verbs) in the participants' written text which was explicitly stated by the instructor—through the audio or video, and slides—and appeared on a transcription of the web-module. Perceived appearance or aesthetic response was measured by the ratings of perceived preference, attractiveness and excitement that the web-module appearance produced in the participants without considering the content of the web-module material. Figure 5 shows the hypothesized relationships between the dependent variables. The data analysis evaluated the effect of video on the dependent variables using within-subject ANOVA, the analysis did not consider the participant responses for the practice trials (trial 1 and 2). A factor analysis was conducted to verify the hypothesized relationships between the dependent variables. SPSS version 11 software was used as the data analysis tool.



**Figure 5. Hypothesized relationships between dependent variables measured in this experiment.**

## Results

**Research Question (1)** *What is the relationship between the use of video in WBDL modules and retention of material as measured by phrase and keyword recall?*

The ANOVA results show a significant difference in the number of phrases recalled by the participants for modules with or without video, as shown in Table 3. This finding is important because it suggest that having the video of the instructor in a multimedia presentation of WBDL material does have a significant effect on the amount of information that is retained by the participants. On average participants recalled about one more phrase when the modules were without video as opposed to modules with video ( $\mu=5.5$ ,  $\sigma=1.4$  and  $\mu =4.8$ ,  $\sigma=1.5$  respectively). On the other hand, there was no significant difference between the presence of video and the amount of keywords that participants used to compose the phases to explain what they remembered from the WBDL modules ( $p>0.30$ ).

**Table 3**  
**Means & ANOVA results for information recall variables and module type.**

Information Recall Variables	ANOVA					Video		Audio	
	Sum of Squares	df	Mean Square	F	p-value	Mean	SD	Mean	SD
Phrase	9.000	1	9.000	4.429	.039	4.75	1.46	5.50	1.39
Keywords	15.016	1	15.016	.950	.334	10.34	3.84	11.31	4.11

**Research Question (2)** Which is the impact of instructor video on appearance judgments as measured by perceived attractiveness, preference and excitement?

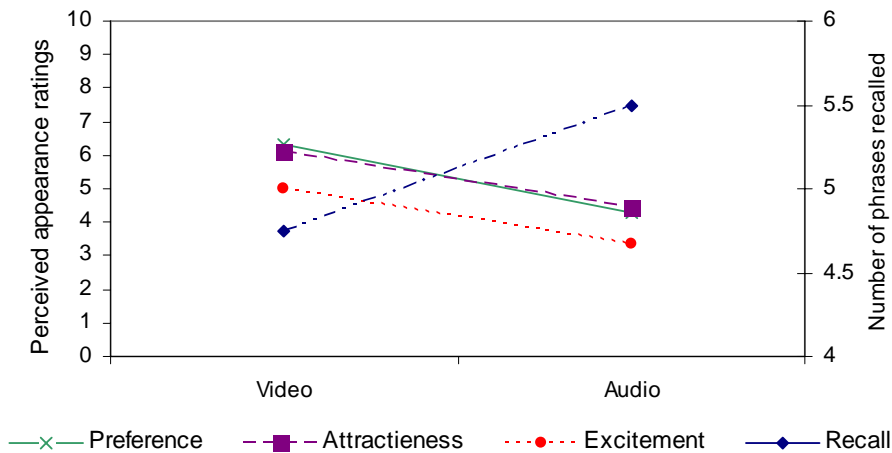
The answer to the question is that there is an impact and a significant difference between the three appearance/aesthetic ratings and the module type (with or without video), as shown in the analysis of variance. Table 4 shows the results for the analysis of variance and the correlations between use of video in WBDL modules and appearance ratings.

**Table 4**  
**Results of analysis of variance and correlation results**  
**for appearance ratings variables and module type**

Appearance/ Aesthetic Ratings	ANOVA					Non Parametric Correlations	
	Sum of Squares	df	Mean Square	F	p-value	r	p-value
Preference	66.016	1	66.016	14.407	.000	-.422	.001
Attractiveness	43.891	1	43.891	9.175	.004	-.345	.005
Excitement	43.891	1	43.891	9.156	.004	-.351	.004

Figure 6 shows the overall mean response of participant perceived preference, attractiveness and excitement of the WBDL modules by module type. The mean response shows that there is an inverse relationship between information recall and appearance ratings. As mentioned earlier, participants recalled a larger number of phrases for modules with no video (only audio) when compared to modules with video. On the other hand, appearance ratings were higher for modules with video, when compared to modules without video.

These significant differences between the appearance ratings for modules with or without video provide support for the learning-preferences hypothesis. This hypothesis states that different people learn in different ways, so it is best to present information in many different formats and as less information is presented, the level of satisfaction of the user would decrease. In this study satisfaction was not directly measured but the results might suggest that appearance variables are related to satisfaction.



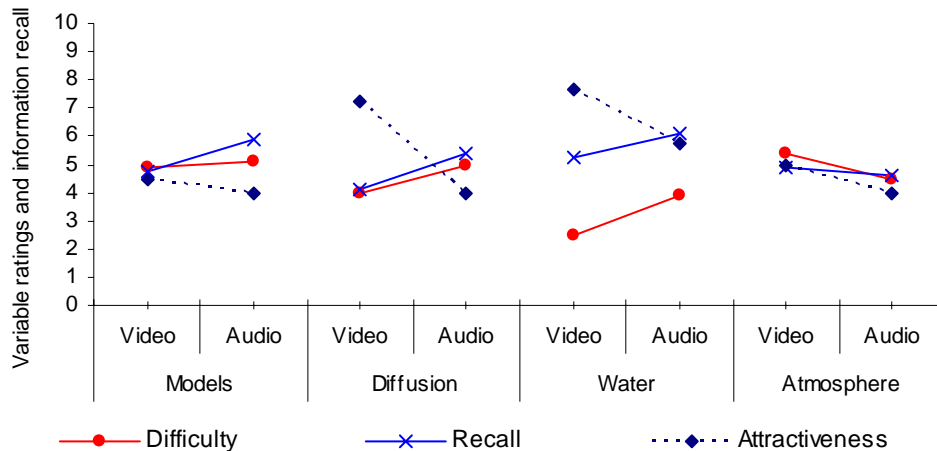
**Figure 6. Mean ratings of appearance judgments and number of phrases recalled for modules with and without video.**

*Research Question (3) What is the relationship between perceived difficulty, module type, information recall, and appearance judgments?*

The difficulty variable was not related to the use of video in the WBDL modules, but it was related to the other dependent variables. There was a significant negative correlation between perceived content difficulty, excitement and attractiveness ratings ( $r = -0.309$ ,  $p < 0.05$ , and  $r = -0.270$ ,  $p < 0.05$  respectively), suggesting an inverse relationship between these two variables. The difficulty variable was also significantly correlated with the phrase and keyword recall variables (both with a correlation of  $r = -0.298$ ,  $p < 0.05$ ).

Figure 7 shows the overall mean ratings of perceived attractiveness, phrase recall and content difficulty for each of the web-modules by type and topic. First, the graph suggests that there is an inverse relationship between content difficulty and attractiveness/aesthetic ratings for most of the modules except for the module on atmosphere and mixing heights. As ratings of content difficulty increase the ratings of perceived module attractiveness seem to decrease but when content difficulty decreases (the content is perceived as simple) the web module appearance is perceived as more attractive (the same trend occurred for perceived excitement).

There is another important relationship shown in Figure 8 with respect to content variables (difficulty and information recall). As mentioned earlier, modules with audio only (no video) have higher information recall but they also are perceived to be more difficult. This seems to suggest that content and appearance/aesthetic variables are related and not independent.



**Figure 7. Overall mean of perceived attractiveness ratings, information recall and content difficulty for the web-modules by module type and topic**

### *Factor Analysis of dependent variables*

This study evaluated the effects of design characteristics on six dependent variables and assumed that all the dependent variables were represented by two main factors. A further analysis of these variables using principal component analysis confirmed that there are indeed two main factors that relate the variables. A factor analysis with varimax rotation was used and the two components shown correspond to the two previously identified major dependent variable groups of content and appearance, as shown in Table 5

**Table 5**  
**Factor analysis results for the dependent measures**

Component Matrix Dependent Variables	% Variance	Original Matrix		Rotated Matrix Method: Varimax with Kaiser Normalization	
		Component		Component	
		1	2	1	2
Phrase Recall	47.6	.288	.837	-.124	.877
Keyword Recall	24.1	.559	.613	.219	.800
Difficulty	11.8	-.575	-.304	-.374	-.532
Preference	7.4	.835	-.358	.906	6.075E-02
Attractiveness	5.1	.842	-.314	.893	.103
Exciting	3.8	.851	-.229	.863	.182

## Discussion

The learning preference hypothesis suggests that as more media channels are included satisfaction will increase. Accordingly, we hypothesized a difference in aesthetic appeal (module preference, excitement and attractiveness) for web modules presented with or without video. The results of this study provided support to our hypothesis. In this study satisfaction was not measured as one of the dependent variables, but preference ratings for appearance judgments. The results suggest that one of the aspects of satisfaction might be related to appearance/aesthetic appeal. Along the same line, the Cognitive Theory of Multimedia Learning, developed by Mayer (2001), predicts that when pictures (e.g., animation), spoken words (e.g., narration) and written words (e.g., text) are simultaneously presented in multimedia presentations, the visual channel will become overloaded. Following this theory, we expected to find a higher recall of phrases and keywords in modules without video than in modules with video. We considered the visual stimulus provided by the video and the slides, in addition to the auditory stimulus of the audio, could possibly overload the participant's visual channel. The results of this study showed a significant relationship between information recall variables and the independent variable, with a higher recall on modules without video than those with video. One possible explanation for these findings is that having video present for multimedia presentations would overload the visual channel, therefore contributing to lower amounts of information remembered. As stated earlier, the Cognitive Theory of Multimedia Learning defines spoken word as narration of present text and pictures as animations in the multimedia presentation, but does not address situations in which a multimedia presentation is defined as a video recording of a lecturer.

With respect to the dependent measures, content difficulty and appearance were found to be significantly correlated. These findings support Baird, et al. (1990) results, which suggested that there is a relationship between affect and cognitive demand. The relationship between difficulty, appearance and information recall is important and a balance should be attained.

The results of this study show that appearance does matter in web-based distance learning technology. This finding is valuable because it clearly shows that studying users' appearance/aesthetic judgments provides important insights to designers and practitioners on which specific variables within the WBDL environment make an impact in learner's perceptions and performance.



The trends in the data between use of video and retention variables, opens an avenue for future research and understanding the participants' tolerances and preferences to different instructor video formats. The impacts of video size, quality, and location within the WBDL module on appearance judgments and learning are possible extensions of this work. Our study and future research in this area would provide scientific evidence to support WBDL environment design decisions integrating the aesthetics perspective.

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## About the Authors



**Cristina Pomales-Garcia**

**Cristina Pomales-Garcia, MS.** is a graduate student and Ph.D. Candidate in the Department of Industrial and Operations Engineering at the University of Michigan. Address: 1205 Beal Ave. Ann Arbor, MI 48109-2117 USA;

tel: 734-764-6473, fax: 734-764-3451,

e-mail: [cpomlaes@umich.edu](mailto:cpomlaes@umich.edu)

**Yili Liu**

**Yili Liu, PhD.** is Arthur F. Thurnau Professor and Associate Professor of Industrial and Operations Engineering at the University of Michigan.

Email: [yililiu@umich.edu](mailto:yililiu@umich.edu)

**Editor's Note:** Advent of the Web as a low cost publishing medium has had a negative impact on educational television. There are many disciplines where distance learning and collaborative activities are best accomplished by television. MIT and its international associates provide us with some of their current experienced with teleconferences for interaction to factor into our plans for distance learning.

## **Connecting Distant Communities through Video Communication Technologies in Design Studio Workshops**

**Federico Casalegno and Larry Sass**

### **Abstract**

This paper focuses on the description of how to use videoconferencing to connect physically distributed communities involved in distant design workshop.

We discuss connected communities using remote collaboration communication technologies and report the results of ethnographic observations carried out during two collaborative distant design workshops held at the MIT -Massachusetts Institute of Technology: Fabricating Ceramics Class, Fall 2002: Generative and Parametric Tools for Design and Fabrication, Spring 2003. During these workshops, MIT students cooperated with other students (IST, Portugal) or with a private company (Fosters & Partners, London) in order to better achieve their design projects.

The goal of this paper is to discuss the use of videoconferencing tools in learning environments in order to improve collaboration among distant communities.

**Keywords:** Connected communities, video-conferencing, remote collaboration, distant communication dynamics, learning environments, interactive digital media.

### **Distant design workshop description**

#### **Classes**

We observed two different collaborative design workshops.

[A] The workshop on *Fabricating Ceramics* focused on the designing process using parametric modeling and prototyping software with ceramics. The workshop was a research seminar using existing prototyping tools in new ways in order to fabricate curved surfaces of varying shape and scale with ceramic materials. The workshop's objective was to work out a designing process, in this case with bricks or blocks, that was similar to Frank Lloyd Wright's buildings using custom made tiles, using computation as the designing generator and prototyping as our beginning and final output. The workshop had also intense online design collaboration with The Department of Engineering at The Instituto Superior Tecnico in Lisbon, Portugal. Students there mainly focused on designing, while students at MIT focused on materials and fabrication.

During the semester, the classes were divided into groups and formed mixed American-Portuguese teams. To improve the collaboration between students and between universities, the teams were composed by MIT students working with IST students. During the semester they had regular on-line collaboration sessions. Remote collaborative sessions were based either upon team-to-team collaboration or upon class-to-class collaboration, which included the entire learning community. In the team-to-team collaboration, the students were working on their own projects, communicating with their remote partners in order to achieve and improve their design project. During the class-to-class on-line collaboration students presented their works; professors

could monitor the status of the design projects and give advice and critics about the following steps. Twenty students took part in the workshop: 12 from MIT and 8 from IST. If we consider the entire learning community, including faculty, teaching assistants and administrators, we have more than 40 people involved.

[B] The *Generative and Parametric Tools for Design and Fabrication* was a collaborative workshop with Foster and Partners (London) that explored a computationally-based, explorative approach to design. Parametric and generative design tools were combined with digital fabrication and rapid-prototyping techniques, in a cyclical process, to generate and evaluate alternative, innovative design solutions to a design problem. The design problem focused on light. 10 MIT students were involved in the workshop, and considering the entire learning community 20 people were involved in this design workshop.

In both workshops, the learning community used a complex collaborative environment, using different interactive media to collaborate and achieve their design project.

### **Remote collaborative learning environment communication technologies**

The goal of the workshop was to use communication technologies to create a continuous space to connect remote communities for a better learning and design experience. One of the innovative aspects of these workshops is the use of different technologies, the way that the learning community collaborated in exchanging knowledge and documents, jointly working on projects and the team-to-team interaction. Here below is a description of the different media we use to connect distant communities.

#### **StudioMIT**

StudioMIT (<http://studio.mit.edu>) is an on-line educational environment that complements the physical studio environment; it is a Web-based platform that supports the community of students, staff, and faculty. During the semester, the learning community used Studio MIT to share files, upload and download documents, create mailing lists, interact in discussion forums, communicate and exchange project related information.

#### **Video and Audio Conferencing**

NetMeeting's audio and video conferencing features allow you to communicate with anyone on the Internet (<http://www.microsoft.com/windows/NetMeeting/Features/default.ASP>). This allows both parties to see and talk to each other; in the case of this collaboration, it allowed the class to present their projects, collaborate and gain valuable and immediate feedback and comments. Features in NetMeeting also include a whiteboard for simultaneously sharing documents, program sharing, and chat and file transfer.

#### **iCom**

This is an MIT-Media Lab project; it connects distant sites. Its normal mode is background, providing continuous ambient awareness between all stations, but at any time it can be transformed into a foreground mode for ad-hoc Tele-meetings or casual interaction, without the need of dialing telephone numbers or waiting for connections to be established (<http://www.medialabeurope.org/hc/projects/icom/>). We also used PictureTel, establishing a high quality of video conferencing.

#### **Email and Instant messaging.**

With Instant Messaging people are able to communicate via instant messages, to chat individually or in a group and send/receive pictures. The students also used email to communicate and participate in the class mailing lists or forum discussions.

## **Research and evaluation methodology**

The research methodology we used is based on 3 complementary steps and it is part of a wider research project on the use of digital media in education (creativity & learning with digital media: (<http://www.media.mit.edu/federico~/creativity>)).

### **[1] Experts**

The first step of the methodology consists of interviewing education and interactive digital media experts. These interviews drive us to investigate the relationship between interactive media and learning, especially focusing on the pedagogical issues emerging with the implementation of new collaborative learning environments and with the use of computational tools for education. This stage provides essentially a generic theoretical framework.

### **[2] Ethnographic observation**

The second step consists of carrying out ethnographic observation during the workshops, observing students and on-going pedagogical activities. Throughout the class and the online and face-to-face collaboration, I took notes and annotated all kinds of information gathered by observing the learning community work in progress. On the other side, I had access to all the students' work through the Studio MIT on-line collaborative platform, or accessing the *mailing list* where the learning community discussed not only about the logistics of the class but also about the social dynamics and the collective works that the class was doing.

### **[3] One-to-one interviews**

The last step consisted in doing one-to-one interviews with all the students involved in the class, using a qualitative research methodology. These interviews took place in a face-to-face situation (Boston, Lisbon and London) and I followed the same interview grid with all the students. The interviews' content has been divided into categories, classified and analysed. I interviewed the entire learning community members at the MIT in Boston, at the IST in Lisbon and at Fosters and Partners in London

## **Design Exchange at a Distance**

### **Design studio**

The definition of a design studio dates back as far as 1823 with methods of teaching with a strict focus on classical design. The school was composed by four stages of learning leading to the designation of a diploma of architecture. [1] The makeup of the Ecole has been transferred to the US by William Ware to the halls of MIT in the late 1860s [2]. The typical MIT studio environment for architects is an open space where students design in groups, where students glance over a desk at fellow students work or exchange comments through late night interactions. The open studio environment started (library). In most schools that environment continues as a model of collaborative learning environments. Now, thanks to new communication technologies, we connect distant learning environments, creating learning connected communities that learn, work and interact from distant places. In that context, a major issue within design studios is to form effective learning communities and to use communication technologies that improve their capabilities. Video communication tools help create stronger connected communities and enormously expand their ability to create and work jointly.

### **Audiovisual technologies for education**

Television and audiovisual techniques for educational purposes have been introduced in the mid fifties [3]; since then, the evolution and the variety of these technologies increased enormously and the debate concerning the pedagogical use of audiovisual techniques for better educational results is still very open. Those techniques are important for two main reasons: the first one

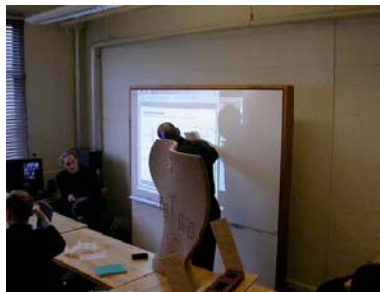
considers the fact that audiovisual techniques allow knowledge transmission and effective information sharing. From a media theory point of view, J. Mayrowitz [4] showed the importance of the introduction of television in educational settings, and of creating a common cultural background between spread communities. From a psychological point of view, D. Kerkchove [5] pointed out how audiovisual techniques deeply influence our cognitive thinking models. From a communication and design point of view, Steve Wittaker [6] studies the implications of using audiovisual technologies for interpersonal communication. The second main reason is that those techniques efficiently improve the collaboration between distant communities. Audiovisual technologies are crucial in the educational process because they are at the crossroad between the exchange of information among communities and their ability to process, assimilate and transform it into knowledge [7]. Moreover, these technologies have an enormous impact on connecting distant communities. Hereafter we are interested in reporting our experience in using audiovisual technologies to connect communities and to improve distant design.

### **Using videoconferencing in design projects to connect communities**

In distant design projects, videoconferencing technologies were mainly used in four complementary ways in order to: lecture at a distance, discuss ongoing projects, allow team-to-team collaboration and, finally, to provide video-cafes and common meeting places for students. These modalities of using video communication technologies foster the emerging of an active learning connected community.

#### **Lectures at a distance and import critics' expertise**

In this case videoconferencing was mainly used to transmit knowledge thus favoring forms of distant teaching and learning. Distant universities could benefit from remote professors in an effective way. Lessons were given from one university to the other in order to create a common knowledge background and to allow different communities of students to share the same level of knowledge and to have the same intellectual tools to work on their design projects.



**Fig. 1: Distant teaching in studio environments**

Secondly, critics from remote experts enriched the team's works. Thanks to audiovisual techniques, students could present their work to critics and benefit from their comments and remarks. Learning from experts at a distance where practitioners teach their specialty in studio, anywhere studio happens, is a very important aspect of the use of audiovisual techniques.



**Figs. 2, 3: Students present and discuss with remote experts in London**

**Project based group discussion**

Project teams regularly presented their works to the entire learning community (including professors, students and invited experts), updating all the members on the state of the art of their projects and favoring exchanges and critics between the various communities.



**Fig. 4: Cross presentation between MIT and IST.**

**Team-to-team collaboration.**

Each small team used the videoconferencing techniques to cooperate with their distant team, to create, comment and discuss their on going projects in a regular basis.



**Fig. 5: Team-to-team collaboration.**





**Fig. 6: Team-to-team collaboration, students sharing sketches.**

### **Video Cafes and common meeting places**

It's very important to have strong ties among community members to improve learning community dynamics. In order to do so, and to develop social capital, mutual trust and to better know each-other, students used videoconferencing systems to chat about non educational issues and mostly focusing to simply getting to know each other, to converse about cultural differences, common hobbies and other topics that improved the community cohesion.

Using videoconferencing in these four different settings allowed us to create a video mediated environment and to provide an efficient technological setting for different modalities of communication. At the same time, this allowed us to foster communication and practice, transforming two separated groups of students into an efficient community of practice. With this methodology, distant communities could interact on aspects related to their design projects and remotely work together in common design projects, but they could also discuss and chat on all kind of topics.

Videoconferencing was the first modality we used and it allowed us to transmit knowledge from the top level of the learning community, from professor to students. It was the most formal modality of interaction, but it was fundamental, from a content point of view, to create a common knowledge background and, from a logistic aspect, to organize the workflow among distant communities.

The second modality was important because it forced each group to systematically produce some sort of sharable artifacts to discuss with the entire learning community.

We designed our learning environments to foster what Seymour Papert [8] defines as constructionism: “[Constructionism] ... attaches special importance to the role of constructions in the world as a support for those in the head, thereby becoming less of a purely mentalist doctrine. It also takes the idea of constructing in the head more seriously by recognizing more than one kind of construction (some of them as far as removed from simple building as cultivating a garden), and by asking questions about the methods and material used” (S. Papert, 1993, p. 143). S. Papert emphasizes the importance of externalised, socially sharable entities, artefacts or objects in the learning process. Learning process is based on the internalisation of the external information and by the externalisation of internal information, in a cyclic perpetual dynamic. This is the way we structured the learning process: students had weekly assignments that they had to work on, print 3D artifacts and construct models that they had to share and comment with the entire learning community. The use of audiovisual techniques is in this case fundamental because it obliges the entire learning communities to work on sharable artefacts that they can talk about during the videoconferences.

The third modality in which we used audiovisual techniques was characterized by a more informal interaction where communication was work related, improving the exchange and the



implementation of ideas into design project. As J. S. Brown and P. Duguid point out, “... the talk and the work, the communication and the practice are inseparable. The talk made the work intelligible, and the work made the talk intelligible. As part of this common work-and-talk, creating, learning, sharing, and using knowledge appear almost indivisible. Conversely, talk without the work, communication without practice is if not unintelligible, at least unusable. Become a member of a community, engage in its practices, and you can acquire and make use of its knowledge and information. Remain an outsider, and these will remain indigestible”.

The last modality was very important in order to develop social ties among distant communities. Conversation about non-project related topics reinforced the construction of stronger social ties among distant communities. It is an efficient way for people to share experiences and we observed a direct proportional relationship between the success in designing innovative projects and the amount of non-project related conversations. Moreover, the continuous video linking was a success for the studio interaction during reviews and non-reviews times. Socialization was just as much a part of the learning and collaboration process as design exchange. Students spent many hours on personal exchange before discussing their design projects.

As in a physical design studio situation, people mix socialization times at the cafés and working times at the desk with socialization times at the desk and working times at the cafés, we fostered the same kind of dynamics using multimode kind of interaction also through video connection. The synergic combination and the parallel use of these four videoconferencing modalities provoked a very important result. We provided the students and the entire learning community a multimode communication visual channel for remote interaction: they used it in multiple ways thus creating a real space for connected communities remote collaboration. Thanks to this multimode videoconferencing they filled a place with human interaction creating a living space for learning.

## **Social Capital, gaze and object oriented talk**

### **Social Capital**

Audiovisual tools, and the communication dynamics that derives from the implementation of those tools in the educational environments, allowed distant communities involved in the workshop to build social capital and increase mutual trust: this is an important as well a fundamental condition to perform collaborative distant design projects [9, 10, 11, 12, 13]. First of all, interacting through video transforms a distant individual into a real person. When people see their partners during videoconferencing they become “real” people, as one of the interviewed students pointed out: “The visual more about a social use... I mean we could see them, so they became real people... I think it was most useful if we were showing them some sketches, so they can understand what’s going on...”. Media are useful to provide different type of interaction: some are more suitable for transmitting strategic-oriented information and others are more suitable for favoring socialization processes. And both are necessary. Videoconferencing is a very important tool for socializing: “I think it was really important because I feel it made me connected with people particularly since we spend so much time on a computer for instant messages and email, I get a lot of mail from people I’ve never seen ... I felt like when we started meeting with them over NetMeeting, it started to be more personal, so I felt like the visual part was really helpful”.

Secondly, a relevant remark on the social capital building dynamics, not related to video-collaboration, concerns the physical meetings. In fact, one of the most relevant aspects of the social capital community building is that communities, to develop social capital, have to meet physically and independently from their purposes. It is during the co-presence interaction that people build mutual trust and social capital. For our workshop, one of the key issues to foster the

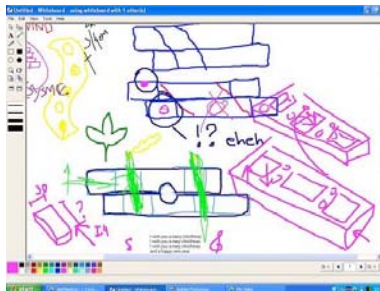
building dynamics of the community was the face-to-face interaction among participants. Workshops participants met at least one time during their design projects. This element helped in a very consistent way the construction of social ties among people, transforming a group of spread students into a connected community. For example, the travel to London solidified internal relationships among MIT community but also the external relationship with the entire learning community. In this case, the visit was necessary to obtain important strategic information for the design projects but also to playfully socialize. The synergy between these two dimensions created an experiential community and created the connected learning community.

Another very important element to understand the building of social ties among the community is that what created a solid ties among community members' is not the structural elements but, on the contrary, the shared experience. For instance, some of the MIT students were Portuguese native speakers. A first hypothesis we had is that Portuguese MIT speaking students would be more reliable and they would help build community ties with IST students. This did not happen because what students were looking for, and what helped the community construction dynamics, was a mixture of conversation on everyday life and design project, socializing and working. In this sense, American students were playfully discussing with Portuguese students, trying to understand another language and another culture, and vice-versa. This was an element that helped to mix socialization and work, and that constructed an experience-based connected community.

It is because we used so extensively multiple modalities of videoconferencing, in a relatively short period, that two distant communities who didn't know each other before starting the collaboration started to socialize and increased their social capital. Social capital is important to successfully achieve distant design projects between remote communities.



**Fig. 7: Students collaborating and jointly working in the same document with on-line videoconferencing.**



**Fig.8: Students commonly working in their design projects and, in the same documents, making fun and adding personal communication.**

### Gaze and object oriented talk

A relevant issue about people involved in collaborative processes through videoconferences is the way people look at each other and how we design workspace with interactive audiovisual technologies. Bell Laboratories carried out the very first studies on the impact of visual perception during videoconferences [14] and since then research on the field grows. As a matter of fact, according to where the two speakers are looking at, you have a more or less important impact in the collaboration processes mediated by videoconferences [15]. From the empirical research, it also emerges that gaze and the perception of it by the others is so important that even when we are not sure whether the other is actually looking at us, we think that our interlocutor is looking us in the eyes. During face-to-face conversation it is fundamental to cross our gazes because it favors collaboration. To this extent the *Snap to contact theory* suggests [15, p.54] that people cannot always judge gaze direction accurately and they will bias their perception toward contact unless they are certain that the looker is not looking at them. Latest research on this topic show that in a collaborative design process, more than focusing on the mutual feedback that the participants send each other during the video-communication interaction, it's important that they first socialize and, second, they use the videoconferencing to focus on the "object" they are discussing more than trying to capture each other's visual signs, gaze and posture to decrypt the meaning of the conversation. In our case, the workspace and the shared "object" that students were working on were the main focus during the video conferencing. Participants, while working on their design project, focused on their work rather than in their visual expression or gaze. As Whittaker points out [16], in videoconferencing the speech alone is often sufficient for effective conversation, visual information about objects is generally more valuable than visual information about work participants. These two conclusions bring him to suggest the failure of current technologies to support talk about objects, arguing that these technologies need to be better integrated with existing communication applications. Also Kraut et al., Luff et al. [17, 18] explore the "objects, not participants" hypothesis, showing how research have focused so far on the "talking heads" communication dynamics rather than exploring the talk about objects during the video conferencing interaction.



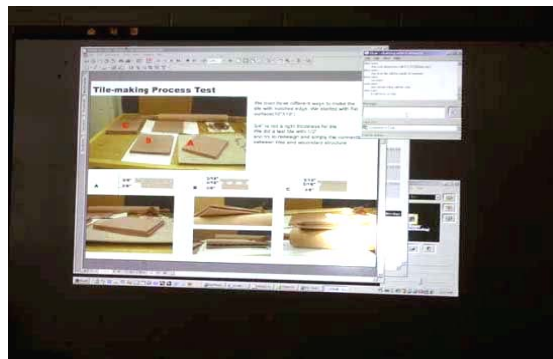
**Fig.9: Students sharing and discussing printed 3D models.**

In our design workshop the sharing of artifacts that happens both in synchronous mode, when students accomplish their assignments and discuss through video conferences their artifact – PowerPoint documents, 3D models, computer models – and in asynchronous mode, when they posted in the Studio MIT on-line environments their work [19], was crucial. This also fosters the creative design process: students used to think about a possible design solution, discuss it, build an artifact, and share it with the learning community, playing with their ideas and deconstructing the artifact. And they started again this process of creating, sharing, deconstructing, storing and starting again. This creative process continuously generates new artifacts that can be shared, discussed and stored thanks to new communication technologies and media environments. This creative model has been studied by Finke, Ward and Smith [20], that proposed two related but distinct phases in the process of creativity: the generative process, where people create the project's structures, and the exploratory process, where people deconstruct these structures and

play and brainstorm with ideas in order to generate the creative results. Though the videoconferences and the class dynamics we fostered these process.



**Fig. 10: Students sharing objects and discussing.**



**Fig. 11: Sharing documents and distant messaging.**

### Sharing context and content

The importance of the “object and not participants” paradigm in the video conferencing doesn’t have to hide the importance of the shared context during the interactions. Firstly, Kraut et al. [21] showed that having the shared visual space helps collaborators understand the current state of their task and enables them to communicate and ground their conversations efficiently. These processes are associated with faster and better task performance. Delaying the visual update in the space reduces benefits and degrades performance. Also Steve Wittaker [6] stresses the importance of a “shared context” in order to make a remote interpersonal communication effective. According to him, the shared context can be a linguistic or a physical context. The video, in order to contribute to this process, must give us information about (1) the object we are discussing and (2) the person who is communicating. He shows how technological work has focused on one specific function of visual information, to support non-verbal communication and neglected functions such as using visual information to initiate communication or depict shared work objects. According to the non-verbal communication hypothesis, visual information is also useful in order to coordinate collaborative process. Moreover, accordingly to the idea of *situatedness*, the interaction between the designer and the environment strongly determines the course of designing. This idea comes from Dewey’s works [22], and it is summarized by J. Gero as “where you are when you do what you do matters” [23]. In new learning collaborative mediated environments, interactive video technologies create new shared environments between distant communities; this influence the design process. According to this view, technologies that do not support non verbal communication are inadequate to favor collaboration between distant communities in technologically mediate environments. On the contrary, all the technologies that give information about facial expressions, gaze and postures of the participants help interpersonal

communications. Technology as iCom that are conceived expressly to improve chance encounters and to connect places through permanent visual connections help distant communities create a shared context and increase the sense of awareness. This helps the distant design process.

### **Digital Fabrication and the Exchange of Design Artifacts**

S.F. Russel, R. Kraut J. Siegel [24] speak of *Grounding* referring to the interactive process by which communicators exchange evidence about what they do or do not understand over the course of a conversation, as they accrue common ground. They underline three important points to successfully perform conversational subtasks, and they mention that interlocutors (a) they must identify what their partners are attending to, in order to determine whether an object is part of their joint focus of attention; (b) they must monitor their partner's level of comprehension, so that they may expand or clarify their utterances if necessary; and (c) they must strive for efficiency in message formulation by constructing their utterances in accordance with Gricean norms for informativeness, brevity, and the like. During the distant design process visual tools are very important to establish a common culture, especially in remote environments. As stated by an interviewed student, "... even if it's not easy for me as an international student sometimes to describe like designer static or the form or shape because that kind of descriptive language is not easy for me to articulate but it's much easier to draw it and show them and then as soon as you see the drawing you understand what this person is trying to do, so one time we had a session with those two people in Portugal who had the same program on their computer and so we sketched and then we showed them and then they just sketched back, so like that kind of communication, visual tool it was really much more helpful!" So visual tools are very important because they give clues of the other team environments as well as clues of the person they are collaborating with (the way people dress, move, talk, make gesture). On the other side, they allow people to jointly work in real time on the same documents, co-creating and exchanging information, comments and feedback on the projects. For many of the students, these visual inputs during the collaboration considerably increased the ties and the cohesion between teams giving the sense of working together.

Moreover, it is fundamental to stress the importance of working together, with "objects" that students mutually manipulate with an innovative communication system that creates a real new communication dynamics. The hypothesis of the object-not-participants underlines the importance of creating a space for communication and not a place for communication. A space where communities collaborate and communicate.

## **Conclusions**

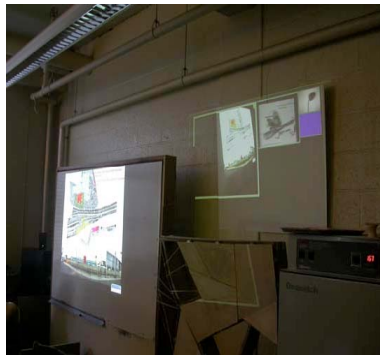
### **Multimode videoconference system**

What made our design workshop successful was the combination of different videoconference modalities. One modality was more inclined to make the socialization processes affective, bringing participants to better know each-other and socialize, increasing the social capital within the learning community. The other videoconferences modalities allowed the remote interaction among participants to focus on shared artifacts and objects, increasing the creative process and allowing students to achieve their design goals. Videoconference tools allow at the same time a dynamics for communication and socialization and a dynamics to discuss work-related and design related topics. First, the synthesis of these two dynamics creates the real richness of the use of multimode videoconferences in educational setting. Secondly, this synthesis creates a real space for interaction and learning, transforming a distant group of people into a connected community. The learning community that emerged from this project is an experiential community: it is not true to say that the design project is a pretext for socialization, or that the socialization is a pretext to accomplish a design work but two dimensions are one the complement of the other. Socialization communication dynamics and communication for working related aspects are

strictly correlated and inextricable and create a performing connected community. Sociality and talking about work create the community even in such a short period of interaction and in a geographically distant setting. A community is not sustainable if structured on a communication merely based on work related topics. Likewise, a community is not sustainable if it is exclusively based on socialization *a-finalized* communication dynamics. In our workshops, videoconferencing technologies, mixing these two dimensions created a successful connected learning community.

## Evaluation

The final review, that also happens through video-conferencing illustrates the positive results of the distant design workshops. The evaluation of the design projects was, generally speaking, very positive: the teams accomplished their design projects successfully and had positive academics notes. The final interviews with students demonstrate that 75% of them were more than satisfied about the implementation of the media environment and the use of videoconferencing for their design projects. 25% of the students who didn't appreciate the videoconferencing tools made up for the minority of the community that used the communication tools only to discuss working and design related topics. They didn't make any effort to discuss about non-design related topics, or they simply didn't look for it. Failing to find other common territory for discussion affected the results of the design projects and the community building dynamics.



**Fig. 11: Final Presentation**



**Fig. 12: Final Presentation.**

## Creating a real space for community interaction

One of the key success elements for these workshops is that we considered that the videoconferences were situated in different places and we had to provide not a mere place for connections but a space for interaction. If in the physical place people interact in multiple ways, we also wanted to provide multiple ways of videoconferencing so people could use the same multimode way to communicate, but taking advantages from the technological tools. In this sense, we worked in order to use the communication efficiently, and not to simply sustain the communication among students. Thanks to interactive media, we fostered the creation of a real space for interaction: to obtain this, we provided a media environment where people could “bring” their own experiential world into the project, transcending the specific functional space. Because people can use videoconferencing to talk simultaneously about their own project and personal life, they became a community that managed to efficiently achieve their design projects.

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## About the Authors

**Federico Casalegno**, Ph.D. is a Research Scientist at the Massachusetts Institute of Technology Media Lab

Email: [federico@media.mit.edu](mailto:federico@media.mit.edu)

**Larry Sass**, Ph.D. is Assistant Professor, Massachusetts Institute of Technology, Department Of Architecture

Email: [lsass@mit.edu](mailto:lsass@mit.edu)



**Editor's Note:** This study tests three e-learning strategies based on psychological theories of learning. A prior analysis shows a variety of factors influence learning; the research design compares implementation based on behaviourist, cognitivist, and constructivist learning theories.

## The Impact of an E-Learning Strategy on Pedagogical Aspects

Felix Mödritscher

### Abstract

Planning and implementing courses – no matter whether done for face-to-face education or within e-learning environments – deal a lot with pedagogical issues. Learning is influenced by factors such as attention, motivation, and emotions as well as by learner characteristics like prior knowledge, cognitive and learning styles, intellectual capabilities and constitutional states. This paper examines learner-centred aspects of e-learning by drawing conclusions from traditional learning in the classroom situation and outlining implications for the process of virtual learning. Furthermore, a case study carried out in the field of adult education tries to point out findings on the impact of different e-learning strategies on the factors influencing learning.

**Keywords:** pedagogical aspects of e-learning, factors influencing learning, learner characteristics, impact of e-learning strategy, virtual learning, case study.

### Introduction

E-learning can be considered to be highly related to learning and teaching as stated in (Jain et al., 2002). Therefore, pedagogy and didactic are important aspects for all facets of e-learning, reaching from the creation of the courseware to application of an e-learning system to the evaluation of the learning progress. (Mödritscher et al., 2006) showed an online course for a certain topic may be implemented in various ways and each method differs in aspects of the teaching process such as the instructional design, effort for the teacher, effectiveness of the teaching strategy, or e-learning platform (in this case the platform used was Moodle).

In this paper, relevant factors of the learning process such as attention, motivation, emotional aspects, and students' characteristics are examined according to different e-learning strategies. Therefore, section 0 derives relevant theoretical aspects for the virtual learning process by examining knowledge transfer within the classroom situation. In the following, section 0 describes the case study about implementing different e-learning strategies, which was carried out at the Graz University of Applied Sciences CAMPUS 02 (Campus02, 2006). In section 0 findings on pedagogical aspects in relation with these e-learning strategies are highlighted.

### Pedagogical Aspects of Learning and Implications for E-Learning

Education can be understood as “activity undertaken or initiated by one or more agents that is designed to effect changes in the knowledge, skill, and attitudes of individuals, groups, or communities” (Knowles et al., 1998). In contrary, the term “learning” emphasises the person in whom the change occurs or is expected to occur. Thus, learning comprises “the act or process by which behavioural change, knowledge, skills, and attitudes are acquired” (Boyd et al., 1980). Tying up to this definition, the following subsections deal with the learner-centred aspects of the traditional learning process –relevant factors for learning, characteristics of learners, and further influences on learning – and examine them within the context of e-learning.

## Factors Relevant for the Learning Process

Drawing conclusions from (Bransford et al. 2000), four factors significantly impact the learning process: (1) attention, (2) motivation, (3) emotions, and (4) experiences of the learner.

1. **Focus of attention** determines if a student mentally follows a lecture and, therefore, the degree of behavioural change. E-learning requires a strategy for getting and keeping the learner's attention. It is necessary to consider cognitive processes such as the learner's selection of incoming data into the sensory memory, organising and integrating this information by building connections in short-term memory and encoding it by transferring it to long-term memory. Thus, it is recommended to apply certain principles for instructional design (Fleming & Levie, 1993).
2. **Motivational states** of students are of importance for stimuli given by the teacher to promote the learning process. (Bransford et al., 2000) state that "*motivation affects the amount of time that people are willing to devote to learning*". Yet, this willingness to learn results from different motives beginning with the intention to achieve something, competing against colleagues, helping other people, or emotional factors like anxiety. (Entwistle, 1981) classified three motivational orientation styles: (a) meaning-oriented, (b) reproducing-oriented, and (b) achieving-oriented motives. Motivational aspects for e-learning may also depend on learning content, pointing out the relevance for an instruction or including interactive elements such as games and simulations. Furthermore, it is advantageous to create competition within a learner group and adapt to pre-knowledge in the subject domain to prevent the students from being under challenged. For instance, (Astleitner & Keller, 1995) describe a framework for adapting instruction to the learner's motivational state in computer-assisted instructional environments.
3. **Emotions**, similar to motivation, have a strong impact on the learning process. (Tobias, 1987) points to findings on students' performance depending on anxiety, in particular test anxiety, and proposes special methods for dealing with such problems. On the other hand, an emotion – whether negative and positive one – may influence learning due to its special nature. With respect to (Paulsen, 2005), "*emotion is an unconscious arousal system that alerts us to potential danger and opportunities*". Thus, addressing a learner's emotional channel can be seen as a key cognitive process for transferring data into the short- or even long-time memory. Within e-learning, the improvement of the learning process can be realised through emotions by storytelling, empathy, provocations, emotional figures and animations, and group works, enabling confidence in the learning content.
4. **Knowledge transfer** can be improved if learners relate **prior knowledge** either in the same domain or in a similar context. (Anderson, 1995) states that "*interference happens, when information gets mixed up with, or pushed aside by, other information*". At the beginning, the degree of mastery of the original subject influences the learning process (Bransford et al., 2000). In particular, an adequate level of initial learning is required. Then, learners can construct new understandings by tying up to previous experiences. In this way, learners become capable of understanding conceptual changes, adopt knowledge regarding their culture or everyday life, and even improve meta-cognitive abilities. Research findings have shown that the higher the level of prior achievement within a domain or a context, the less instructional support is required to accomplish a task (e.g. Tobias & Ingber, 1976). Referring to (Tobias, 1994), prior knowledge strongly relates to interest in the subject. Considering prior knowledge within online courses, the macro-adaptive instructional approach described in (Park & Lee, 2004) deals with the necessity to determine learning objectives, define dependencies between instructional units and assess the students' competencies to grant access to restricted instructions.

These aspects are highly dependent on the learning content so that well-established e-learning standards – such as the specifications of SCORM (ADL, 2004) – fulfil these requirements.

### Learner Characteristics

Individual differences have a strong impact on learning (Cronbach, 1957). According to literature, learners differ from each other in learner characteristics:

1. **Intellectual capabilities** exhibit a unique profile for each learner that can be characterised by Multiple Intelligences (Gardner, 1993) or cognitive abilities (Snow, 1986). Education deals with the theory of multiple intelligences in two ways: On one side, teachers devise curricula addressing different intellectual capabilities. On the other side, educators focus on development of specific intelligences such as intra- or inter-personal skills. Although it is difficult to consider each learners' intellectual abilities within the typical classroom or e-learning situation, (Kelly & Tangney, 2003) applied Gardner's theory within an intelligent tutoring system named EDUCE.
2. **Learning preferences** are influenced by context and predispositions or orientations to learning (Jarvis & Woodrow, 2001). Preferences can be classified in four different areas: (a) environmental, (b) emotional, (c) sociological, and (d) physical (Dunn et al., 1989). Preferences are considered in e-learning environments in various ways such as adapting language, presentation of learning content, and group models (Brusilovsky, 1996).
3. **Cognitive and learning styles** are related to intellectual capabilities and preferences to provide practical models for teachers. Cognitive styles, such as field-dependence, reflectivity versus impulsivity, haptic versus visual, and the forth, characterise modes of perceiving, remembering, thinking and decision making. Learning styles like holist versus serialist, perception styles, and concept formation approaches, describe the connection between instructional presentation and materials with a student's preferences and needs (Schmeck, 1988). Practical models like the WAVI model by (Riding, 1991), the AdeLE project (AdeLE, 2006), learning styles (Kolb, 1984), and the AHA! System (Stash et al., 2004), have been developed.
4. **Constitutional attributes and states** of learners involve physical properties of the body like disability, age, and amblyopia as well as short-term conditions such as tiredness, concentration, emotional and motivational states (Mödrischer et al., 2004). These factors are well-documented; for instance disabilities as stated in (Sánchez & Flores, 2004) and constitutional states of learners such as learner attention (Ueno, 2004).
5. **Self-efficacy and meta-cognition** influence the learner achievement (Bandura, 1982). Self-efficacy comprises a student's evaluation of the ability to perform a given task through different senses. Meta-cognition stands for the awareness of the process of learning and consists of two basic processes: (a) monitoring the learning process and (b) adapting the learning strategy (Winn & Snyder, 1996). According to (Park & Lee, 2004), meta-cognitive abilities examined by various researchers within the area of aptitude-treatment interaction (ATI) are highly related to the learners' experiences and have an impact on different variables, such as the degree of feedback and tutoring, the locus of control, and personality attributes. In particular, various systems in the scope of adaptive hypermedia, as with methods like adaptive navigation support, focus on learner control (Brusilovsky, 1996).
6. **Background knowledge** of a learner comprise language and computer skills as well as experience in a related situations and contexts. The impact on learning is illustrated by reports that students from abroad have problems understanding the language (Campbell

et al., 2004), and these are connected to learning styles s. (Felder & Henriques, 1995) Thus, (Mödrischer et al., 2005) suggest providing translations for problematic phrases to support the learning process. Various approaches in e-learning focus on experience in work related areas, the user's profession, experience with the learning platform (Brusilovsky, 1996), and foreign language students (EPHRAS, 2005). The INCENSE system offers the ability of identify and analyse different learning situations and, if necessary, automatically switching among them (Akhras & Self, 2000).

7. **Prior knowledge and experience** in the domain is the last and most relevant characteristic of learners. (Vassileva, 1996) differentiates between experience and real knowledge about a topic, where experience determines the user's model of a knowledge space, the way of browsing through and mastering tasks in a domain, etc. Similarly, (Bransford et al., 2000) state that people having developed expertise in a particular area are able to think effectively about problems in this area and, therefore, differ from novices. Both factors are relevant for the learning process as shown in the last section. Thus, most theoretical models – e.g. the macro-adaptive instructional approach dealing with adaptation of the learning process according to the student's pre-knowledge and dependencies between instructional units (Park & Lee, 2004) – and systems – like AHA, ELM-ART, INTERBOOK, KBS, PT, and the forth (Henze, 2000) – focus on the prior knowledge of a learner. Experience is considered within the field of various research fields such as adaptive hypermedia, e.g. by methods like adaptive navigational support for browsing through a hyperspace (Brusilovsky, 1996).

Based on these seven classes of learner characteristics, it is clear that the result of learning is highly dependent of the individual learner. Therefore, teachers, e-learning content creators and online instructors have to know pedagogical aspects and provide alternate methods to support different learner needs. Additional factors influence learning as shown in the upcoming section.

### Further Influences on Learning

The previous section dealt with learner-dependent attributes that affect the learning process. Further aspects – given by didactics or related to learner characteristics – may influence learning.

Referring to (Krapp et al., 1992), **interest** in a certain domain depends on aspects of prior knowledge, emotions, and motivation as discussed earlier. It is assumed that interest is derived from expertise and positive experiences that enhance the learner's self-confidence. When supported by a didactical strategy, e-learning can adapt to support the interest factor. For example, the learner may be allowed to choose preferred learning content, or this can be derived by statistical methods from learner responses, taxonomies and IR-based strategies. Learning management systems may focus on motivation or prior knowledge, or self-organising hypertext maps like the KnowledgeSea (Brusilovsky & Rizzo, 2002) or environments supporting constructivist learning that navigate course concepts (Mödrischer et al., 2005).

A didactical key issue is about **remembering and forgetting**. While these processes are highly related with intellectual capabilities, meta-cognition, prior knowledge and motivation of learners, a teacher might antagonise the forgetting curve (Ebbinghaus, 1964) by regularly repeating relevant content. To define such key concepts within a course, teachers choose learning objectives, appropriate teaching strategies, e-learning environments and specific learning content. Examples include typical concepts with a macro-adaptive instructional approach (Park & Lee, 2004), competency-driven strategies realised in the study introduced in this paper, and options for instructional sequencing within the specifications of SCORM (ADL, 2004).

Another didactical aspect is **time to learn** or the so-called time on-task. (Bransford et al., 2000) point out the necessity to give the student enough time to reach an appropriate level of experience within the scope of a certain domain, especially for a complex subject matter. Nevertheless,

learners are often faced with a situation in which a teacher tries to “cover” too many topics too quickly, which hinders effective knowledge transfer for different reasons. On the other hand, time on-task should be limited so that the learner is sufficiently challenged and self-efficiency is able to increase. It is particularly important for e-learning to plan the time allocated for learning and the time really spent on learning. As pointed out in (Dietinger, 2003), one advantage of e-learning is that learners can go through course materials at their own pace. Deadlines must be set realistic in order not to frustrate students. Ability to define and manage deadlines for instructional units is provided by commonly known specifications for e-learning content and learning management systems, even by open source solutions such as Moodle (Moodle.org, 2006).

Depending on the given learning objectives, issues like **feedback and tutoring** might be of relevance for the learning process. In particular, if a course aims at mediating high-level objectives, skills, or behaviour, immediate feedback is important for successful learning (Thorndike, 1913). With respect to (Park & Lee, 2004), various research areas, such as aptitude-treatment interaction or the micro-adaptive instructional approach, deal with giving feedback and provide technical solutions like intelligent tutoring systems (ITS) or techniques for natural language dialogues. Furthermore, (Mödrischer & Sindler, 2005) suggest methods such as simulations, games, automatically graded essays, and quizzes created with professional authoring software.

Finally, learning is also affected by the **context** in which knowledge transfer takes place. According to (Bransford et al., 2000), learners might be able to learn in a certain context, but fail to learn or transfer experiences gained to other contexts. Contextualised knowledge is used in e-learning environments such as INCENSE. As this issue is highly related to constructivist theory, new paradigms, such as application of a dynamic background library to support context-driven learning (Mödrischer et al., 2005), are import.

Concluding this section, it has to be pointed out that the issues depicted so far comprise just the most relevant and learner-centred factors of the learning process. A complete overview detailing the complexity of learning can be read in (Bransford et al., 2000). Nevertheless, it can be stated that the most critical factor for successful learning is the learner. The most important difference between the classroom situation and e-learning is that a teacher can adapt the learning process much more effectively by holding a lecture in the class, since communication in both directions – from the teacher to the learners and vice versa – is faster and more effective. It is much harder to evaluate and react to factors in the learning process or learner characteristics via e-learning platform. Nevertheless, research mainstreams such as adaptive instructional systems or adaptive e-learning (Park & Lee, 2004) are designed to deal with these aspects of adaptation in e-learning environments to improve the learning process.

To examine pedagogical issues, the next two sections report a case study implementing different e-learning strategies and examine their impact on the learning process.

## Setup of the E-Learning Study

After identifying the need for realising e-learning phases within its educational concept at the Graz University of Applied Sciences CAMPUS 02 (Campus02, 2006), an internal project was initiated with the aim to support lecturers to implement their e-learning strategy within the area of adult education. The study introduced in this section is one of the project’s outcomes and describes an online course about the topic “document formats”. The course was carried out over a period of two month and realised according to a full virtual concept using a customised version of the Moodle e-learning platform.

The course was essentially a lecture on basics of information technology to teach competencies and some higher levels of objectives. Based on Bloom’s Taxonomy (Bloom et al., 1956), the

learning objectives comprise five “Level I”, four “Level II”, and two “Level III” objectives of the cognitive domain, two “Level III” objectives of the psychomotor domain and one “Level III” objective of the affective domain. To realise different e-learning strategies, three courses were implemented and each of the 38 students was assigned to one of these courses according to the achievement levels of a prior topic-related lecture. Referring to (Mödrischer et al., 2006), the three courses can be characterised in the following ways:

- Course A was planned with respect to **Behaviourism**. The teacher organized objectives and content into three modules. Fourteen students were assigned by the teacher to study each module and on completion, measured achievement levels using an online examination. The course included game related activities, allowing several attempts in the exam, an increasing difficulty level, a task to gain a bonus, and other interactive ways to keep learners motivated. The learning process was assessed by typical behaviourist tools like multiple-choice questions, task assignments, or short written answers. To examine the high-level objectives of the psychomotor and affective domain, ITS methods were simulated by the teacher.
- Course B employed the ideas of **Cognitivism**. Tasks were characterised by classical cognitive elements, for instance repeating learning content in different ways, working out parts of the course within a group work or re-structuring the content. This course was divided into two phases: First, three groups consisting of four students each had to work out a part of the overall objectives. In the second phase, the groups were reassembled to four groups with three members, while each group had to restructure the results of the first phase using a WIKI environment. To motivate groups, the best work of the second phase was awarded a bonus. To assess the learning process, the results of each phase were graded by the teacher based on the quality and quantity of students’ work within the group. The WIKI environment allowed reproducing the student’s effort within the group.
- Course C employed **constructivistic learning** realised in four groups consisting of three students with the materials and task to create a manuscript for mediating all learning objectives of the course. In the second phase, the three members of each group had to compare the works of the other groups and evaluate them by distributing a certain amount of points and reasons this distribution. Again, the group with the best work received a bonus. Group works were graded by the teacher on basis of the students’ peer reviews.

While the e-learning phase was in progress, students were instructed to document certain aspects, such as the effort for learning, a self-assessment on reaching the objectives, the learning materials used. An unannounced and challenging examination as well as a post-questionnaire was carried out in the lecture held after the e-learning experiment. Based on the whole amount of data retrieved from this e-learning experiment, the next section examines the impact of the e-learning strategy on pedagogical issues.

## Findings on pedagogical Aspects

In accordance with section 2, this section deals with two issues of evaluating the e-learning study. On the one hand, selective learner characteristics are examined in two ways, for all participants and for the students of each course. On the other hand, the factors relevant for the learning process are analysed for each e-learning strategy. For both approaches, all data collected during and after the e-learning phase is exploited.

### Assessing the Learner Characteristics

Findings on the learner characteristics are derived from the post-questionnaire, where the students had to evaluate and rate certain statements. As the literature manifests, students’ self-assessment of learning behaviour is often wrong and psychological tests are more reliable. The statements of

this questionnaire are formulated in a way that students cannot infer the learner characteristics. Furthermore, the questionnaire was performed immediately after the e-learning phase, so that significant differences between the courses might be found. Results of the post-questionnaire concerning typical learner characteristics are summarised in Table 1.

Considering prior knowledge (1) about the course's topic, most students agreed with this statement and meant to have good experiences and knowledge within the course's domain. This can be reasoned due to the students' experiences from their jobs as well as to former lectures dealing with a few parts of the learning content. The even distribution across the three courses may be a result of the students' assignment to the courses described in section 3. While the overall interest on the online course (2) is rather average, students of behaviourist e-learning strategy seem to be less interested in the topic than the other students that mastered the course with group tasks.

The students' preferences (3a-e) underlie some surprises. First of all, students through all courses strongly dislike learning on the screen. Secondly, their attitudes towards preferring online tests to written exams differ from disagreement in course B to a slight agreement in course C. Similarly, students of course C more strongly prefer open-ended to closed questions than students of course B. Furthermore, students of the behaviourist approach are slightly negative about learning in a group, while the students of the other courses are positive. Applying interactive elements seems to be neutral and evenly distributed amongst the students of all courses.

**Table 1**  
**Results of the Post-questionnaire Concerning Learner Characteristics**  
(each statement rated with a number between 1 and 5 comprising the range from "absolute disagreement" to "strong agreement")

Self-assessment of Learner Characteristics	Overall ( $\bar{x}$ / $\sigma$ )	Course A ( $\bar{x}$ / $\sigma$ )	Course B ( $\bar{x}$ / $\sigma$ )	Course C ( $\bar{x}$ / $\sigma$ )
1. Extensive prior knowledge about topic	3.7/1.0	3.7/0.9	3.6/1.3	3.8/0.9
2. Interest in the course's topic	3.1/1.2	2.8/1.3	3.2/0.9	3.3/1.2
3a. Preferring online learning to reading printouts	1.8/0.9	1.8/1.0	1.9/1.1	1.7/0.9
3b. Preferring online tests to written exams	2.9/1.2	2.8/1.4	2.5/1.2	3.3/1.1
3c. Preferring open-ended to closed questions	3.5/1.1	3.5/1.3	3.2/1.1	3.8/0.9
3d. Preferring learning within a group	3.1/1.1	2.8/1.1	3.5/1.0	3.1/1.0
3e. Preferring interactive elements	3.0/1.1	2.8/1.2	3.2/0.8	2.9/1.3
4a. Acquiring knowledge by typical cognitive processes (structuring, summarising)	4.0/1.0	4.2/0.7	3.8/1.3	4.0/1.0
4b. Intensively studying complex content	4.2/0.9	4.5/0.7	4.1/1.0	4.0/1.1
4c. Need to practice new skills	3.9/0.9	4.2/0.9	3.9/0.6	3.7/1.0
4d. More wholist than analyser	3.5/1.2	3.7/1.3	4.1/0.9	2.8/1.2
4e. More imager than verbaliser	3.5/1.1	3.7/1.0	3.3/0.8	3.5/1.0

5a. Understanding background by research or questions (related to Kolb's "converger")	2.9/1.0	3.3/1.0	2.7/0.9	2.6/1.1
5b. Meaning-oriented learning of important concepts (related to Kolb's "assimilator")	4.4/0.7	4.5/0.8	4.6/0.5	4.2/0.7
5c. Tying up to own experiences (related to Kolb's "diverger")	3.9/0.9	4.2/0.7	3.7/0.9	3.8/1.1
5d. Finding practical examples for theoretical content (related to Kolb's "accommodator")	4.1/0.8	4.4/0.7	4.2/0.6	3.7/1.0
6. Easy to be motivated by game-based elements or competitions	3.3/1.3	3.5/1.3	2.9/1.3	3.6/1.2
7. Preferring autonomous to teacher-driven learning	3.1/1.1	3.2/1.2	3.3/0.9	2.7/1.2

Summarising the findings on cognitive styles (4a-e), the students' ratings for the statements were rather high, which means they agreed about acquiring knowledge by typical processes or the need to practice new skills. The self-assessment of the so-called WAVI-factors outlines that students consider themselves to be more wholist and visualiser. Particularly, the wholist factor shows strong differences between course A and B to course C. Nevertheless (Phillips, 2005) states that learners are – for different reasons – not good judges of their style and that even psychological tests are not fully reliable in assessing cognitive styles.

Referring to Kolb's learning style inventory, four questions (5a-d) focussed on evaluating the students' learning behaviour by means of being more active or reflective in the learning process as well as thinking in a more abstract or pragmatic way. Overall, the students participating in the three courses see themselves as rather reflective learners, while there is no clear tendency for abstract or pragmatic thinking. Analysing the groups of the three courses, students of course A seem to rate their attitudes towards diverging and converging higher than the participants of the other courses. In contrary, students in course C do not consider themselves being as good accommodators as in the other courses. Generally, these results of the students' self-assessment are unreliable due to the reasons stated above for the ratings of the WAVI-factors.

Concluding the results of the post-questionnaire, both game-based elements (6) as well as autonomous learning (7) are rated neutral by the overall class. Hence, students of course A and C are more convinced of the fact that game-based elements improve their motivational states slightly. On the other side, self-directed learning is seen much more positive in course A and B – the two courses mainly driven by the teacher – than in course C, which implemented a constructivistic approach.

Finally, it has to be stated that background knowledge was considered by the teacher in three ways: Firstly, the course was given in German, the students' mother language. Secondly, the teacher introduced the students to the Moodle platform in the lecture, before the e-learning phase was started. Thirdly, the students attended a technology-focused study for two and a half year. Overall, the students should not have had problems with the course's language as well as with the usage of the system. Analysing the questions about the system's usability and the quality of the learning material, these two aspects were – excluding some problems about using the WIKI



module in course B – not mentioned at all by the participants. In contrary, students stated that the Moodle platform can easily and intuitively be used.

### Analysing the Factors of Learning

Considering the factors influencing the learning process (see subsections 0 and 0), two sources are of relevance for the findings of this analysis: (a) the distribution of the students' activities, and (b) the students' ratings of the statements of the post-questionnaire.

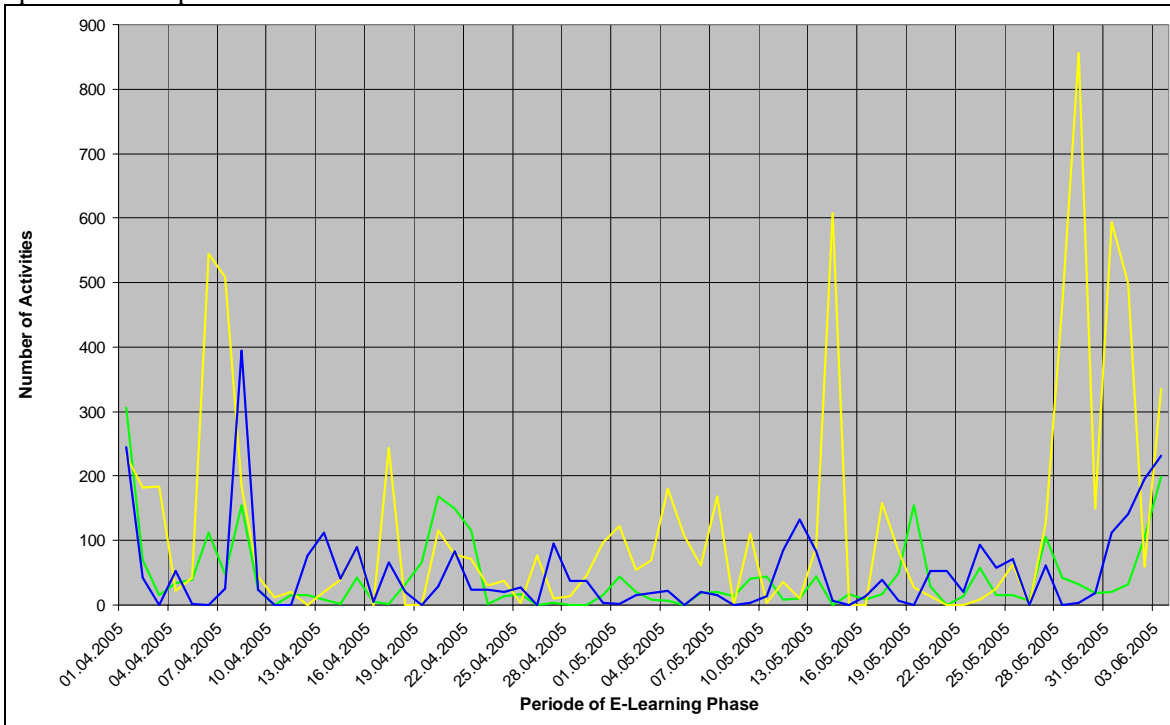
Analysing the **students' attention** within the online courses, the distribution of the course activities and certain characteristics is useful, but does not cover all findings concerning attention. Particularly, it is not possible to infer something about the students' behaviour while learning offline. Nevertheless, Table 2 (the courses' characteristics) as well as Figure 1 (overall number of students' activities) document that students of course B had to work much more with the Moodle system than the participants of the other courses. Interpreting the results of the concluding examination in this context, the high degree of learning within the Moodle platform does not really imply a high degree of attention, because students of course B performed worse than others. Further, several students of this course stated that the WIKI module lacks of good usability and they had to concentrate more on the tool than on the learning content. Thus, good usability of a learning management system is an important factor for a high degree of the students' attention and adequate results in learning.

**Table 2**  
**Characteristics of three Courses based on Students' Documentation about Learning and raw Database Queries within the Moodle System**

Characteristic	Course A	Course B	Course C
Students' self-assessment of average effort [in h]	12.2	9.4	7.6
Students' self-assessment of mastering objectives	92.9%	46.8%	74.3%
Students' self-assessment of the necessity for the lecturers notes	68.8%	31.3%	62.1%
Students' self-assessment of using external material	14.3%	43.3%	29%
Students' self-assessment of learning alone rather than in a group	96.9%	69.2%	98.8%
Results of the concluding exam	54.8%	37.4%	43.2%
Overall number of the students' activities	2696	8037	3162

**Emotional states** of the students can be summaries by three observations: Firstly, the instruction to upload a photo of each student as profile avatar causes a lot of activities in the discussion groups of all three courses (see lines in Figure 1 around the 5<sup>th</sup> of April). Students considered this to hurt their privacy; some started emotionally driven discussion threads, while others refused to

upload a valid photo.



**Figure 1: Distribution of the students’ activities for the courses A (green), B (yellow), and C (blue)**

Secondly, the evaluation of course B was worse than the one of the other courses due to the usability problems and the higher effort resulting already depicted. Thus, several rather emotional comments such as “I hate e-learning”, “The task is senseless”, etc. were written down in the post-questionnaire, while students in the other two courses were not that offensive and negative. Further, the higher effort compared with the other courses was criticised (see Table 2). Thirdly, the curiosity about the learning content was rather neutral and evenly distributed over the three courses (see statement 1 in Table 3).

The students’ **motivation** for learning is examined by the following three findings: Firstly, in course A the deadlines (see the green line in Figure 1 around the 21<sup>st</sup> April, the 19<sup>th</sup> May, and the 2<sup>nd</sup> June) are more obvious than in the courses implementing group works (see the yellow line around the 6<sup>th</sup> May and the 2<sup>nd</sup> June as well as the blue line around the 13<sup>th</sup> May and the 2<sup>nd</sup> June). Due to the increasing activities ahead of the deadlines, it seems that a behaviouristic approach enforces students to accomplish the examination right before the module ends. Secondly, each course included some motivational elements as stated in section 0 as well as some statements about the necessity to reach the objectives. Yet, students of the courses A and C meant to master the objectives better than the participants of course B, which highly correlates with the results of the concluding exam (see Table 2). Thirdly, the motivation to complete the tasks was, according to the questionnaire’s statement 2 (see Table 3), average in course A and slightly negative in the courses B and C.

**Table 3**  
**Results of Post-questionnaire concerning the Factors relevant for Learning**  
 (each statement rated with a number between 1 and 5 comprising the range from “absolute disagreement” to “strong agreement”)

Self-assessment of	Overall	Course A	Course B	Course C
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Learner Characteristics	$(\bar{x}; \sigma)$	$(\bar{x}; \sigma)$	$(\bar{x}; \sigma)$	$(\bar{x}; \sigma)$
1. Curiosity about learning content	3.1/1.1	3.2/1.3	3.0/1.2	3.2/1.0
2. Strong motivation to accomplish the tasks	2.6/1.0	2.9/1.0	2.5/1.0	2.4/1.1

Aspects of prior knowledge were already examined in the last subsection. Moreover, the teacher considered the **tying up to prior knowledge** by giving practical and well-known examples for theoretical learning content as well as cross-references to other lecturers. According to cognitivism, issues concerning **remembering and forgetting** were realised only in course B. Yet, these considerations seemed to have failed due to the bad learning results of this course. Finally, **feedback and tutoring** for each course differed depending on the three learning theories: While it was necessary to actively stimulate the participants' learning in course A, students of course B required immediate feedback about the completed tasks. In course C, the teacher had to suppress any comment on the works submitted. Overall, the three courses as well as the learning outcomes differed in several aspects of the learning process as shown in this section.

## Conclusions and Recommendations

To conclude this paper, I have to outline that learning is a very complex process depending of various factors and influences with each of them concerning especially the learners themselves. Thus, an instruction implementing online courses has to consider two relevant aspects: On the one side, the target group of a course needs to be analysed by means of the learner characteristics. If required, the teacher might also apply some classroom assessment methods to assess certain information about the learner within the learning process. On the other side, it is necessary to adapt the learning process towards the findings about the learners. Yet, it is not worth evaluating all characteristics, whether the effort to assess one is too high or the relevance or applicability to serve as a basis for adapting of the learning process is missing.

Summarising the study, it was shown that each e-learning strategy following one of the commonly known learning theories – the Behaviourism, the Cognitivism, and the Constructivism – is realisable for an online course within the scope of adult education. Further, each didactical strategy has a more or less strong impact on the factors influencing the learning process and the self-assessing of learner characteristics. For applying one of the e-learning strategies, it is recommended to analyse certain learner characteristics, particularly prior knowledge and motivation, to prevent the learners from failing to finish the course and to assess various characteristics to optimise the learning process. Nevertheless, there are also some didactical aspects to be considered for realising an e-learning strategy. Issues such as the impact of the learning objectives determined or the assessment strategy implemented have to be examined as part of my future work.

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## About the Author



**Felix Mödritscher**

**Felix Mödritscher** is researcher, software engineer, and project manager at the Institute for Information Systems and Computer Media (IICM) at the Graz University of Technology. Further, he is lecturer on the courses information design and knowledge management at the Graz University of Applied Sciences Degree Program in IT and IT-Marketing (CAMPUS 02). He has a M.Sc. (Dipl.-Ing.) in Computer Technics (Telematics). His research interests focus on pedagogical, didactical, and technological issues of e-learning as well as knowledge management.

Felix Mödritscher  
Institute for Information Systems and Computer Media (IICM)  
Inffeldgasse 16c  
8010 Graz, Austria

Phone: +43 316 873 5622 Email: [fmoedrit@iicm.edu](mailto:fmoedrit@iicm.edu)

**Editor's Note:** Omur takes us on a short journey that emphasizes the importance of literature research to avoid "reinventing the wheel"!

## **Conducting a Qualitative Research in Online Courses: Experiences of a Novice Researcher**

**Omur Akdemir**

### **Abstract**

Online courses are very popular nowadays. New skills are needed to teach online courses and different skills are needed to conduct qualitative studies in online courses. This article provides experiences of a novice researcher to conduct a qualitative research in online courses. Problems and challenges encountered while conducting a qualitative study in online courses are explained.

**Keywords:** Online courses, qualitative research method

### **Introduction**

"The qualitative research approach demands that the world be examined with the assumption that nothing is trivial, that everything has the potential of being a clue that might unlock a more comprehensive understanding of what is being studied" (Bogdan & Biklen, 1998, p. 6). Being able to conduct a qualitative research is a necessary skill for researchers in social science. To understand the methods and techniques associated with qualitative research, lots of researchers complete qualitative research courses. As part of qualitative research course requirements, many researchers are asked to conduct at least one research in an area of their expertise.

This article describes the experiences of a researcher who completed the first qualitative research experience with faculty members teaching online courses. Relatively well-defined procedures have already been determined and used for years to conduct research in traditional settings. However given the history of online education and nature of the Internet-based delivery environment, less is known about conducting qualitative research in online courses. This paper presents issues that the researcher encountered while conducting a qualitative research for online courses.

### **Qualitative versus Quantitative**

Numbers and calculations have important place in our lives. Probably it is because many individuals have to use them in their daily life often. Many people have an initial belief that a research can be objective only if everyone interprets data in the same manner. At the beginning, it seems impossible to achieve objectivity without using numbers. However after conducting several interviews and observation for the qualitative research project, the initial perception of the researcher about conducting qualitative research with online course professor has changed. It is essential not to categorize responses of individual to understand the phenomenon deeply. Schwandt (1999) states that the phenomenon of understanding lies at the heart of the qualitative inquiry enterprise. Bogdan & Biklen (1998) describes the data collected for qualitative research as soft, which is rich in description and not easily handled by statistical procedures. After the first interview with the faculty member, the researcher realized that faculty members had more to tell rather than answering researcher's predefined interview questions. Learning stories of online faculty members and concerns could not be achieved even with predefined interview questions or well-defined quantitative research questions. Having collecting more information about the research question, the researcher realized that researchers could be objective even they have to

investigate the phenomenon in all their complexity. Bogdan & Biklen (1998) describes this effort by saying that what qualitative researchers attempt to do is to objectively study the subjective states of their subjects (p. 33). Qualitative research method has strengths over quantitative research method when researchers are interested in understanding the phenomenon deeply. However it is a challenge for qualitative researchers to be objective when studying the subjective states of their subjects.

## Where to Start

The researcher was intimidated at the beginning of the qualitative research because the researcher had not completed any qualitative work before the course. The researcher had no clue where to start, what to study and what to do. After searching on the web to find at least one or two sample qualitative research studies and completing course reading, the researcher developed an initial idea about the research topic. However the researcher was still worried about whether the selected topic is too broad to complete the research on time. Bogdan & Biklen (1998) urge the novice to pick a study that seems reasonable in size and complexity so that it can be completed with the time and resources available (p. 51). How would researchers make sure that their research is reasonable? The researcher realized that it was not that much important what question researchers have at the beginning of the research but it is important what research question researchers can generate while the study progresses.

Although Bogdan & Biklen (1998) recommend novice researchers to pick places where they are more or less strangers, the researcher did not follow this advice and thought that knowing people and setting would provide the researcher several benefits such as easy to access information and people. After all, it was true that the researcher was able to reach faculty members teaching online courses to conduct interviews despite of faculty members' busy schedule. However the researcher then realized that there were also disadvantages of knowing faculty members too, which was realized after starting to conduct interviews. The major disadvantage of knowing participants from whom data were collected was that participants did not think it is necessary to explain all details to the researcher.

## Conducting Interviews

Although qualitative research books urge novice researchers that qualitative studies are labor-intensive, the researcher did not realize at the beginning how much time a researcher would spend to conduct interviews and observations. All interviews that the researcher conducted took thirty minutes each. Initially it was interesting for the researcher to ask more questions and gather more information about the research question but the researcher at the end realized the difficulty of transcribing them after sitting in front of the computer to transcribe the first interview. It took five hours to finish transcribe the first interview for the researcher. It is difficult to estimate how long transcribing takes (Bogdan & Biklen, 1998, p. 130). While the interview progresses, participating faculty members started to realize more think about the issue and wanted to talk more about them rather than directly answering the researcher's questions.

The researcher had several concerns when preparing to conduct interviews. Probably the major one was trying to create a pattern by asking specific questions. The researcher assumed that it would be much easier to do coding of data if specific questions were asked. However, the researcher realized that faculty members had more to say rather than answering predefined questions. Their stories made interviews and the research even more interesting. After reviewing several qualitative research articles, the researcher realized that there were other researchers defining interview question before interviews too. Riessman (2002) states same issue by saying that "subsequently I realized that participants were resisting our efforts to fragment their experiences into thematic (codable) categories our attempts, in effect, to control meaning." After



the first interview experience, the researcher changed interview questions when the new issues emerged. Bogdan & Biklen (1998) address this issue by saying that even when an interview guide is employed, qualitative interviews offer the interviewer considerable latitude to pursue a range of topics and offer the subject a chance to shape the content of the interview (p. 94).

## How to Observe an Online Course

Emerson, et al (2001) defines the fieldnotes as a means of providing descriptive accounts of people, scenes and dialogue, as well as personal experiences and reactions, that is, accounts that minimize explicit theorizing and interpretation (p. 35). In addition to conducting interviews, observation is also required to be done. The researcher investigated faculty members' experiences in online courses. Thus the researcher was not certain about how to do observation in online courses. Due to the short history of online courses, there was not any guide or suggestion to do observation in online courses. After talking with faculty members, the researcher decided to attend chat sessions of online courses. The researcher was not expecting to find something that might contribute the research but it was interesting to observe that studied faculty members act differently in online courses and many other topics emerged after observing the chat sessions.

## Conclusion

It is important for researchers to understand the nature of their study. Each method either qualitative or quantitative has strengths and weaknesses. Specifying what purposes the research findings are going to be used and knowing the nature of the phenomena would help researchers to choose the right research method. Experience is important for qualitative researchers. The most important thing for novice researchers to remember is to keep the advice of experienced researchers. Learning from mistakes is important but being aware of possible mistakes and preventing yourself from doing those mistakes is much more important, so from the first experience of the researcher, it is suggested that reading existing literature and learning more about the method is probably the most important competency that researchers should have before starting to conduct qualitative studies in setting that they are not familiar.

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## About the Author

Omur Akdemir, Ph.D. is a Research Assistant at Zonguldak Karaelmas University. Ereğli, Zonguldak Turkey. Email: [oakdemir@syr.edu](mailto:oakdemir@syr.edu)