The aim of the Journal of Asynchronous Learning Networks is to describe original work in asynchronous learning networks (ALN), including experimental results. Our mission is to provide practitioners in online education with knowledge about the very best research in online learning. Papers emphasizing results, backed by data are the norm. Occasionally, papers reviewing broad areas are published, including critical reviews of thematic areas. Entire issues are published from time-to-time around single topic or disciplinary areas. The Journal adheres to traditional standards of review and authors are encouraged to provide quantitative data. The original objective of the Journal was to establish ALN as a field by publishing articles from authoritative and reliable sources. The Journal is now a major resource for knowledge about online learning.

JALN

The Sloan Consortium
A Consortium of Institutions and Organizations
Committed to Quality Online Education

ISSN 1939-5256 (print)
ISSN 1092-8235 (online)

Journal of Asynchronous Learning Networks

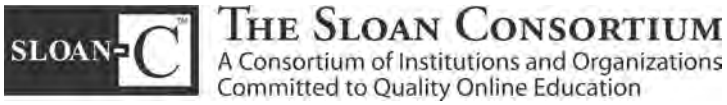
JALN

Volume 13 Issue 2 - August 2009

Journal of Asynchronous Learning Networks

Volume 13, Issue 2 - August 2009

JALN



The purpose of the Sloan Consortium (Sloan-C) is to help learning organizations continually improve the quality, scale, and breadth of their online programs according to their own distinctive missions, so that education will become a part of everyday life, accessible and affordable for anyone, anywhere, at any time, in a wide variety of disciplines.

Cover design by Leighton Ige.

Printed in the United States of America

0 9 8 7 6 5 4 3 2 1

International Standard Serial Number 1939-5256 (print)

International Standard Serial Number 1092-8235 (online)

Journal of Asynchronous Learning Networks

Volume 13 Issue 2 August 2009

This book was made possible by a grant from the Alfred P. Sloan Foundation.

Editorial and Advisory Boards

The Sloan Consortium, Inc. is a consortium of higher-education providers sharing the common bonds of understanding, supporting and delivering education via asynchronous learning networks (ALNs). With the mission of providing learning to anyone anywhere, the Sloan Consortium seeks to provide new levels of learning capability to people seeking higher and continuing education. For more information about Sloan-C, visit www.sloanconsortium.org.

IMPLEMENTING AN ENTERPRISE INFORMATION SYSTEM TO REENGINEER AND STREAMLINE ADMINISTRATIVE PROCESSES IN A DISTANCE LEARNING UNIT

M'hammed Abdous
Wu He
Center for Learning Technologies
Old Dominion University

ABSTRACT

During the past three years, we have developed and implemented an enterprise information system (EIS) to reengineer and facilitate the administrative process for preparing and teaching distance learning courses in a midsized-to-large university (with 23,000 students). The outcome of the implementation has been a streamlined and efficient process which has delivered higher faculty satisfaction at a substantial cost reduction. In this paper, we propose a new conceptual and operational framework for process reengineering (PR) in higher education institutions. We also share our practical experience gained while designing, developing, and integrating three subsystems into an EIS. We hope that our experience, delineated in this paper, will help other universities' distance learning efforts and will encourage them to implement enterprise information systems to effectively manage their administrative processes.

KEYWORDS

Distance Learning; Enterprise Information Systems; Systems Integration; Business Process Reengineering (BPR)

I. INTRODUCTION

Enterprise Information Systems (EIS) and Enterprise Resource Planning (ERP) are complex systems used to integrate and manage dispersed processes and transactions, using a common data source. Many sophisticated systems have been developed to assist in reengineering business processes in manufacturing, in customer relationships, and in supply chain [1, 2]. EIS has also penetrated higher education administrative and academic systems as a planning, decision-making, and information management tool.

Following Pairat & Jungthirapanich's [3] chronological review of ERP implementation in business and industry, we have identified three sequential phases in the history of the implementation of EIS in higher education institutions. During the first phase, EIS were implemented as a replacement to aging legacy systems; EIS have traditionally been adopted to manage administrative systems such as human resources and student, financial, and development information [4, 5]. During the second phase, EIS implementation has progressively evolved to include academic systems and services, including portals, course management systems, digital content repositories, e-portfolios, and e-services. Finally and more recently, under the pressure for greater accountability and the development of data mining techniques, EIS are used as data sources for academic analytics tools aimed at improving enrollment management, fund-raising,

and overall teaching and learning [5, 6, 7].

For example, both the California State University system and DePaul University (IL) have implemented customer relationship-management systems to manage the process of developing and maintaining long-term relationships with students [8]. Brigham Young University-Hawaii recently implemented Oracle's enterprise software (PeopleSoft Solutions) to enhance its service to students, to streamline processes, to improve interdepartmental communication, and to strengthen security across its IT system. As Villano [8] describes, these integrated systems communicate with students at critical points throughout the lifecycle of their relationships with their institution's processes at recruitment, at admissions and enrollment, and upon graduation.

However, EIS implementation is still absent from the routine administrative and academic transactions of higher education institutions where administrative and academic units' processes and procedures are still paper-based. On-campus units are still using word processing and spreadsheet applications to collect, manage, and track most course-related information, including syllabi, textbook ordering, copyright clearance, software requests, coursepak requests, and exam proctoring forms. This paper-based process is particularly cumbersome, inefficient, and difficult for distance learning units [9], and it appears to increase faculty workload and dissatisfaction.

Moreover, in spite of the substantial growth in distance and online learning offerings [10], our review found that the majority of the literature regarding online and distance learning has paid little attention to reengineering or streamlining operational processes within distance learning units. Curiously, this inattention is not aligned with the increasing internal and external pressures demanding greater accountability and efficiency from higher education institutions.

By implementing Enterprise Information Systems to streamline administrative processes and to integrate data, distance learning units are likely to improve their organizational efficiencies and to reduce their operational costs while enhancing both their services and their communication with faculty and students. In this regard, EIS implementation is achieved by following or combining one of two options: by using either vendor-packaged or in-house-developed systems.

We chose the second option because we intended to reengineer our unit's administrative processes while developing the application, a goal hardly achievable when using a vendor-packaged option. From this perspective, our decision to develop an EIS was driven by three specific goals: a) to replace a cumbersome and inefficient paper-based logistics process with a streamlined and efficient Web-based process, b) to increase distance learning faculty satisfaction while enhancing our unit's quality of service, and c) to reduce the overall cost associated with preparing and teaching distance learning courses for faculty as much as possible, using innovative technologies. Of these three goals, we consider faculty satisfaction (as reflected by workload reduction) as the most important indicator of success for our initiative, because faculty satisfaction is a key motivator for faculty participation and involvement in distance learning, [11].

Although we used (Business Process Reengineering) BPR as methodological framework, our initiative differs from traditional business BPR approaches in that it didn't have specific cost-saving nor downsizing goals and targets. Based on a departmental initiative, our reengineering process was structured to focus solely on rethinking processes and procedures within our university's distance learning unit.

II. PROCESS REENGINEERING FRAMEWORK

The concept of reengineering was defined in the early 1990s. Hammer and Champy [12] defined reengineering as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical temporary measures of performance, such as cost, service, quality and speed" (p. 46). Closer to the organizational culture of higher education, and prior to Hammer and Champy [12], Penrod & Dolence [13] defined reengineering as "using the power of modern information technology to radically redesign administrative business processes in order to achieve dramatic improvements in their performance" (p. 8). The ultimate goal of process reengineering is to achieve efficiency and effectiveness by radically rethinking existing processes. This contrasts with Total Quality Management, which undertakes process change gradually by working in incremental steps [14]. As our initiative was to replace a paper-based logistics process with a streamlined and efficient Web-based process, and to achieve major improvements through this reengineered process, our unit decided to thoroughly redesign the process by following the BPR approach.

Using the BPR approach, we proposed, and have successfully initiated, a framework inspired by two main sources: (1) a retrospective analysis of our own experience in reengineering several internal processes (faculty development program management, online course development, syllabus creation process, and learning assessment lab registration), and (2) our reading of the BPR literature [13, 15, 16, 17]. By combining these two sources (in which theory has been nurtured by practice), our framework [18] provides a well-grounded tool for use when reengineering any process in higher education. As shown in Figure 1, this framework for process reengineering in higher education is structured around four sequential non-linear phases:

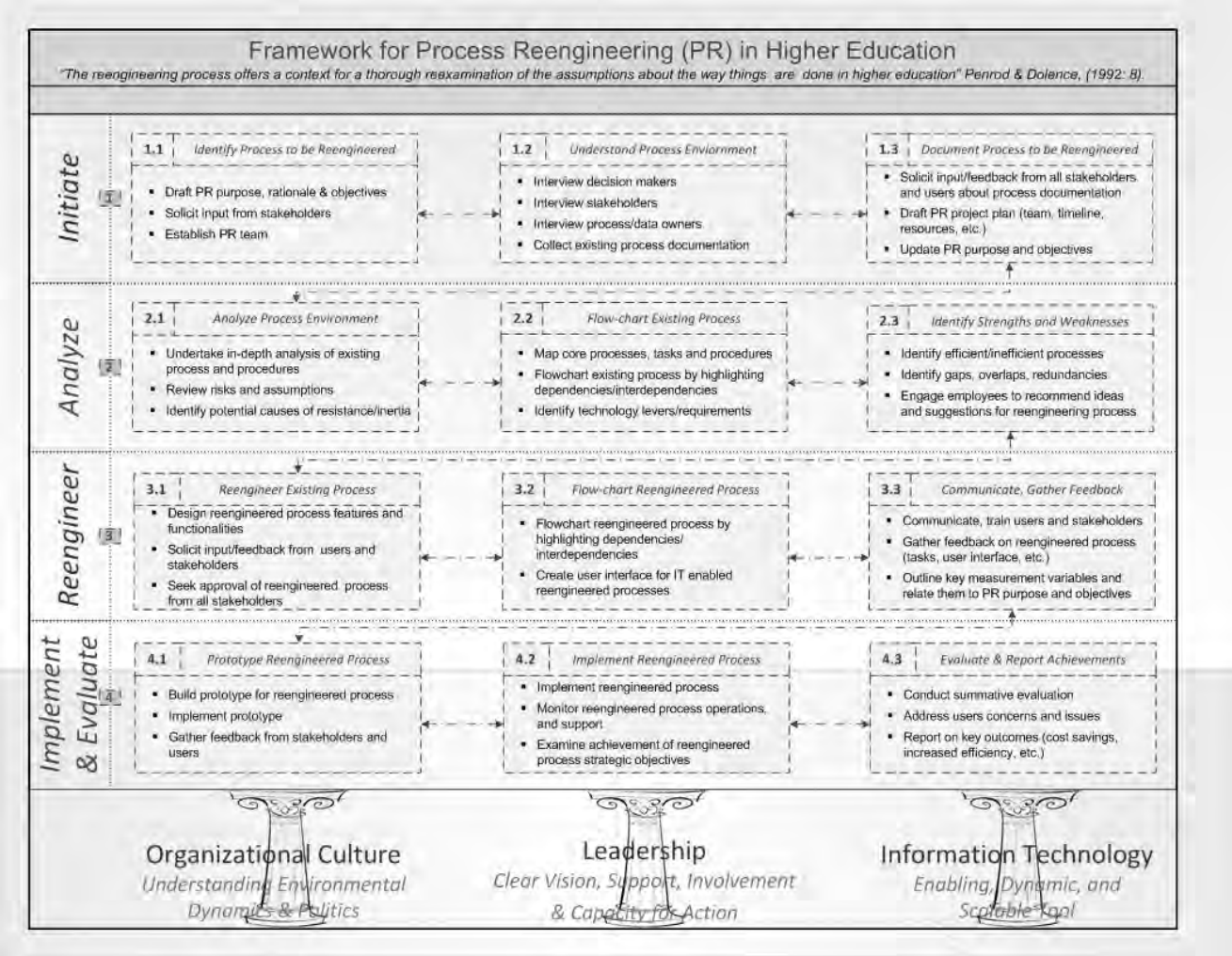


Fig 1. Proposed Process Reengineering Framework

A. Initiation

The first phase is aimed at identifying and understanding the purpose, the rationale, and the objectives of process reengineering. This phase requires active participation from all stakeholders, both to document and to understand the environmental dynamics and the risks associated with the proposed reengineering process [19].

B. Analysis

The second phase is an in-depth analysis of the process tasks and procedures which is completed by analyzing tasks, by reviewing risks and assumptions, and by identifying potential causes of resistance and inertia. Along with the documentation obtained during phase one, the outcome of this analysis phase is used to flowchart the process. A visual presentation of the existing process dependencies and interdependencies is not only critical to mapping the core tasks and procedures of the process, but is also foundational for the reengineering process itself.

C. Reengineering

In the third phase, the features and functionalities of the reengineered process are redesigned. This phase includes active participation and feedback from all appropriate personnel and users. As the process is redesigned, the flowchart outlined in phase two is updated to include a clarification of the key measurement variables. In this phase, information technology is used as an enabling and facilitating tool.

D. Implementation and Evaluation

The implementation and evaluation phase is intended as a first step toward prototyping the reengineered process in order to address users' and stakeholders' issues and concerns. In a second portion of this step, the reengineered process is fully implemented and monitored to ensure successful operation. A summative evaluation is conducted, and achievement and outcomes are reported.

Successful implementation of this framework requires three key pillars: 1) a deep understanding and familiarity with the organizational cultures of both the distance learning unit and the larger university, with full knowledge of their dynamics and politics [19]; 2) a clear vision, involvement, and support from senior leadership [14] sustained by a "capacity for action" [20]; and 3) the intelligent leveraging of information technology as an enabling, dynamic, and scalable tool [17, 21].

III. DEVELOPMENT AND INTEGRATION OF THE ENTERPRISE INFORMATION SYSTEM IN OUR UNIT

Our distance learning unit is part of a large public research university at which roughly fifteen percent of enrolled students are taking distance learning courses. The university is nationally regarded as a leader in technology-mediated distance learning, having offered technology-delivered distance learning since the mid-1980s. In order to rethink our processes and procedures, we built three subsystems guided by the process reengineering framework and then integrated them into our large-scale enterprise information system. To successfully integrate these subsystems, we used a faculty orientation website which has allowed us to streamline and simplify administrative processes for faculty preparing and teaching distance learning courses.

A. Organizational Situations Before the Implementation of EIS

Before the EIS applications were developed and deployed in our unit, we used a combination of paper forms and Excel spreadsheets to manage our operations. As an example, between Summer 2006 and Summer 2007, 37,688 registrations were recorded, and 593 instructors taught 1,281 course sections. Faculty manually completed a plethora of paper forms and then submitted them to the Office of Distance Learning for processing and routing to different units across the nation and across the globe. With such a large volume of paper in motion, managing administrative processes (such as syllabus preparation, the collection of various course-related forms, the distribution of course materials, and the logistics of scheduling paper-based exams) was challenging and sometimes overwhelming [9]. Indeed, in addition to burdening faculty members with the completion of numerous paper-based forms for each course, this manual approach burdened the distance learning (DL) staff with a variety of tracking, processing, and retrieving problems. It was discovered, as semesters went by, that the storage and retrieval of these forms became cumbersome and problematic. In short, the submission of paper forms was costly, cumbersome, and inefficient, and made tracking and managing difficult.

B. New Enterprise Information System Implementation

Our System implementation followed the four-step framework outlined in Figure 1, above.

1. Initiation

In this phase, we identified the administrative process to be reengineered using our unit's years of experience in dealing with the preparation and propagation of distance learning course material, syllabi, and exams. We established our understanding of the process a) by reviewing a variety of sources including original paper reports, manuals, and forms; and b) by interviewing current staff and administrators in distance learning and, perhaps more importantly, by interviewing faculty members teaching distance learning courses.

In order to thoroughly examine the administrative processes in our distance learning unit, we conducted a number of meetings with related stakeholders (DL administrators, DL staff, and DL faculty) in order to cultivate a supportive environment, to gain feedback, and to document the process to be reengineered. Through these multiple meetings, we established our project development team, drafted our project plan, and defined team roles, accountability, expectations, and timelines, in order to facilitate the project management process.

2. Analysis

In this step, we conducted an in-depth analysis of the tasks and procedures involved in the administrative process. In-depth evaluations and analysis of the current paper-based approach were made and artifacts were collected. As a result, we flowcharted the existing process and identified a list of issues and problems to be addressed. After ten formal meetings, our team made a number of recommendations for the reengineered process which included new features, functionalities, requirements, and ideas. Enhancing the performance of actual users (faculty members) in the context of their real-world activities was a major design focus of our system design. For example, at least three staff members recommended that the new system should allow faculty to adopt forms from previous semesters for current use so that faculty could reuse/update previous semesters' forms. This suggestion was built in to our new system. User profile information was used to pre-populate generic form fields in order to reduce the data entry time for faculty. After the faculty filled out the online forms, PDF documents should be automatically generated for viewing and printing purpose. From the outset, reducing faculty workload associated with distance learning courses logistics was a major design focus of our system design.

3. Reengineering

In this step, we designed the features and functionalities of the reengineered process, based on the results of the analysis in the second step. We created a conceptual model of the phases, tasks, and functions, which led to a series of database-related entity-relationship diagrams. Subsequently, we formalized this conceptual design by creating a web-based user interface involving all system users. We realized the importance that all system users need to be involved from the start, and continuously throughout the implementation because it is not realistic to expect no change in designs while a system is being built. Thus, these designs were also regularly reviewed and updated with all system users to reflect new changes. This participative approach during the design phase enabled us to capture users' concerns and feedback early in the process and to reach a consensus as to the workability of the reengineered process.

During the reengineering process, an instructional designer, two instructional technologists, and an interface designer were involved in the actual system programming and development. All applications

chosen were database-driven environments intended to streamline the administrative process. To deploy the system on the Web, a Microsoft MSSQL server was used as the backend database environment. This server was chosen because of its rich capabilities in supporting the required functionalities. In order to create dynamic web content by querying the database, PHP was used as the scripting language. CSS was used to ensure the overall consistency of the system's look and feel. A user-account authentication system maintained by the University's Center for Learning Technologies was incorporated in order to prevent unauthorized access to the online form services, thereby enforcing the security of the application.

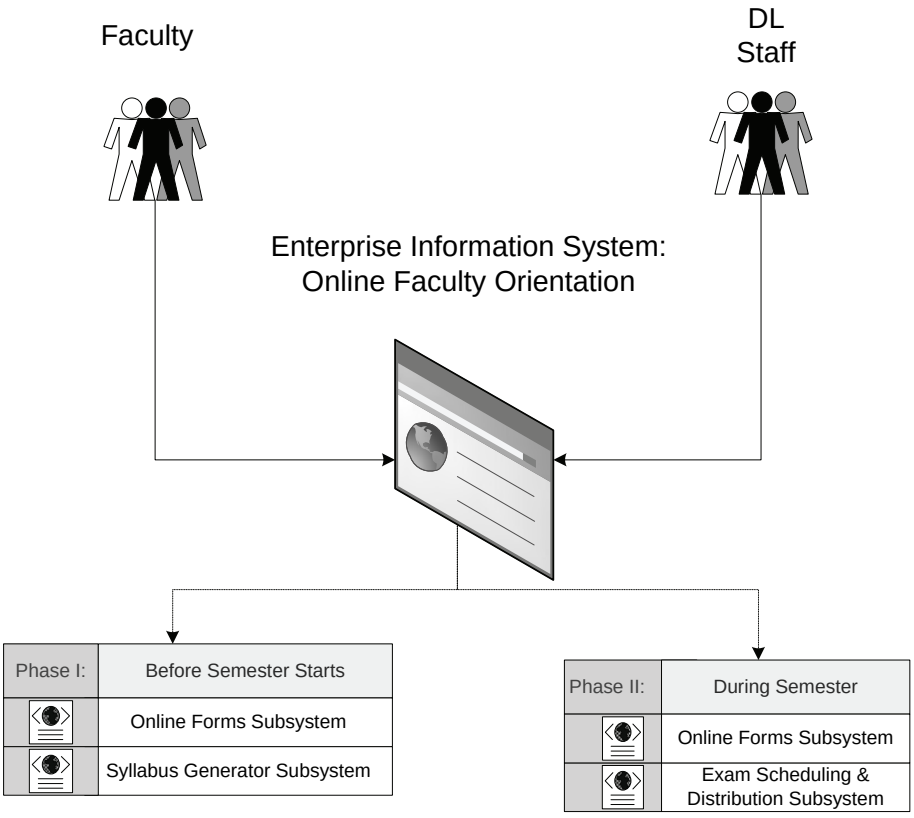


Fig 2. Reengineered Process Features and Steps

4. Implementation and Evaluation

The development team adopted a rapid application development approach [22] in building the three subsystems (the syllabus generator, the exam scheduling and distribution, and the online forms). Based on the entity-relationship diagrammed in Step 3 above, we designed a database using a Microsoft SQL server followed by a shared login/authentication module. Next, we created a separate module that included access privileges and features for each user. The three subsystems were then integrated into a fully functional system through the faculty orientation website. The user features and functions were prototyped and tested three times with real data prior to the actual deployment of the subsystems. The three applications have now been through multiple revisions, based on feedback collected from hundred of users.

IV. EVALUATION OF THE ENTERPRISE INFORMATION SYSTEM COMPONENTS

As the success of an enterprise information system often depends heavily on its usability, we surveyed our distance learning faculty to capture faculty feedback and to explore their overall satisfaction with the functionality and user interface of each subsystem. Since faculty concerns about the workload associated with distance learning are often reported as a disincentive to their participation in teaching distance learning courses [23, 24, 25, 26], the top management of our unit considered the faculty's level of satisfaction to be a key indicator of the success of this BPR implementation.

At this stage, two surveys were administered to users of the Syllabus Generator and the Online Exam Scheduling and Distribution subsystem. (The online forms subsystem was not yet finalized, and so users could not yet be surveyed.) In addition to the formal data collected from the survey, DL staff working with faculty collected informal feedback from faculty using the system. This non-systemic survey approach generated dissimilarities in terms of the number of surveyed faculty per subsystem and the overall response rate for each survey.

A. Syllabus Generator Evaluation

The Syllabus Generator was designed to streamline syllabus creation and management as it provides faculty with a step-by-step tool to create, manage, and submit syllabi online. We conducted four hands-on workshops in which faculty members were asked to create syllabi without any help and without any instructions from the workshop facilitator. These workshops, and this approach, provided us with intuitive feedback and valuable suggestions. After we made the changes based on the feedback and suggestions we received during and following the workshops, we sent a web-based survey to all faculty members using the syllabus generator in order to explore their overall satisfaction and to assess their perception of the usability of the subsystem.

A quick analysis of the survey data indicates that 29 faculty, representing various disciplines and colleges, completed the survey. Overall, approximately 68% of the reporting faculty noted that they were satisfied with the Syllabus Generator. Their feedback indicated that the Syllabus Generator is easy to use (68.18%) and reduces their time in preparing syllabi (40.91%). It might be noted here that the first time anyone uses a new system, unfamiliarity with its workings can serve to diminish satisfaction rates, which usually rise in conjunction with user familiarity with the system. Faculty members also reported that the Syllabus Generator helped them to communicate their course goals and expectations to their students (54.54%). As a result, this tool reduced students' questions about course logistics (45.45%). Most participating faculty members (59.09%) expressed their willingness to recommend the tool to their colleagues.

B. Exam Scheduling and Distribution Subsystem Evaluation

The Online Exam Scheduling and Distribution Subsystem was intended to streamline and facilitate exam and material distribution to Distance Learning students. A total of 32 faculty members representing various disciplines and colleges completed the survey about the Exam Scheduling and Distribution Subsystem. Overall, 51% of reporting faculty members indicated that the subsystem was easy to use. Their feedback indicates that this subsystem: a) enables faculty members to accomplish tasks more quickly (54%); b) reduces the time and effort in managing exam schedules and in distributing materials to Distance Learning students (42%); and c) makes it easier to meet submission deadlines (60%). The evaluation results suggest that more than half of the participating faculty members have a positive attitude about the subsystem's ability to assist them.

C. Online Forms Subsystem Evaluation

The online forms subsystem was designed to offer required forms for face-to-face, hybrid, online, and televised courses. The forms available include the textbook order form, software installation form, coursepak production request form, and copyright permission request form. Each year, more than 100 faculty members use the online forms subsystem to submit various course-related forms. Informal feedback collected by DL staff indicates that the majority of faculty using the system are pleased with the change from paper-based forms to the new online form. Faculty report that the subsystem is a time-saving and convenient tool for the management of forms and that it improves the performance of DL operations. The subsystem also enables all parties involved in the process to work together asynchronously and remotely.

Since a cost-benefit analysis is traditionally required to demonstrate cost savings in BPR projects, we cautiously report that our project has generated both direct and indirect cost savings. Our unit accounting office has calculated the annualized cost-saving attributed to the reengineered subsystem at $7500, which accounts for the portion of the mailing budget spent on sending paper forms. This estimate includes only the direct costs associated with mailing charges that were saved (roughly 8% of the total mailing cost). We expect that this percentage will increase once all DL faculty members use the subsystem. In indirect cost savings, the new functionalities of the subsystem have freed faculty and staff from several time-consuming clerical tasks and have increased faculty and staff productivity in handling the logistics process. Unfortunately, the exact amount of cost savings resulting from increased faculty/staff productivity, reduced faculty/staff labor, and reduced faculty/staff time spent on the exam distribution and scheduling process is difficult to measure.

As for the costs associated with implementing these projects, we mainly used our existing hardware and software resources, and spent only around $2000 in purchasing software (such as a PDF document converter). The rest of the cost was merely the cost of staff time given to the projects. A thorough analysis of the costs and cost savings associated with reengineering the logistics process is suggested as future research. It is important to note that the tangible and non-tangible benefits associated with faculty satisfaction, considered one of our main goals of this initiative, are difficult to quantify. Among those intangible benefits is the fact that faculty satisfaction affects students' learning experience and satisfaction, and might lead to greater faculty interest and involvement in teaching distance learning courses.

V. LESSONS LEARNED

Overall, the whole process of development and integration of the three application subsystems (the syllabus generator, the online forms and the exam scheduling and distribution) took nearly three years to complete. Through the development and subsequent use of the three subsystems by distance learning faculty, a number of lessons have been learned, including the following:

Providing faculty support is crucial. Faculty members have different needs and proficiency levels with technology. In order to be responsive and to help faculty use the EIS, technical help and individual training is provided to answer faculty questions.

An easy transition to the electronic forms is critical. In order to avoid disruption of normal course delivery operations, both paper and electronic forms have been made available to faculty for a given transitional time. We also chose to implement the new system via a phase-in approach, in order to facilitate faculty involvement. Convincing and encouraging faculty to use the EIS will lead to the

discontinuation of paper-based forms.

Tracking the timely submission of syllabi, forms, and exams is essential. Some faculty members are tardy in their completion of required tasks. This system provides DL staff with the capability to track and remind faculty of upcoming due dates.

Faculty involvement and top management support are important factors for success. The changes from a paper-based approach to an EIS approach must involve both DL staff and faculty in the design and implementation of the reengineered processes and systems. Also, top management support is critical to the success of the development and implementation of the EIS.

VI. CONCLUSION AND FUTURE WORK

In sum, despite a slight resistance from staff (which is typical of BPR implementation, when building around any legacy system), we believe that we have achieved our stated goals in terms of: 1) replacing a cumbersome and inefficient paper-based exam distribution and scheduling process with a web-based, streamlined, and efficient process, and 2) reducing both the faculty/staff workload associated with the clerical tasks of scheduling exams and the overall costs associated with exam distribution. The increased level of satisfaction from both faculty and staff proves that our effort and investment in this project were worthwhile and indicates the success of our initial BPR implementation. We believe that the increased familiarity of faculty with the EIS will undoubtedly cause their overall satisfaction rates to rise.

The next step in our research is to conduct a thorough analysis of the costs and cost savings associated with the reengineering of the logistics process using accurate metrics such as ROI (return on investment) to reflect the financial impact of this BPR implementation upon our unit. We also like to conduct a longitudinal study to investigate whether the BPR implementation has an impact on the overall expansion of our distance learning programs during the next five years.

VII. REFERENCES

1. **Shang, S. and P. Seddon.** Assessing and Managing the Benefits of Enterprise Systems: The Business Manager's Perspective. *Information Systems Journal* 12*(*4): 271–299, 2002.
2. **Alvarez, R.** Examining Technology, Structure and Identity during an Enterprise System Implementation. *Information Systems Journal* 18(2): 203–224, 2008.
3. **Pairat, R. and C. Jungthirapanich.** A Chronological Review of ERP Research: An Analysis of ERP Inception, Evolution, and Direction. *Proceedings of Engineering Management Conference, IEEE 2005*, 2005.
4. **King, P., R. Kvavik and J. Voloudakis.** Enterprise Resource Planning Systems in Higher Education. *EDUCAUSE Center for Applied Research Bulletin* (22): 2002. http://www.educause.edu/ir/library/pdf/ERB0222.pdf.
5. **Goldstein, P. and R. Katz.** Academic Analytics: The Uses of Management Information and Technology in Higher Education. *EDUCAUSE Center for Applied Research* (8): 2005. http://www.educause.edu/ir/library/pdf/ers0508/rs/ers0508w.pdf.
6. **Campbell, J., P. DeBlois and D. Oblinger.** Academic Analytics: A New Tool for a New Era. *EDUCAUSE Review* 42(4): 40–57, 2007. http://connect.educause.edu/Library/EDUCAUSE+Review/AcademicAnalyticsANewTool/44594.

7. **Norris, D., L. Baer, J. Leonard, L. Pugliese and P. Lefrere.** Action Analytics: Measuring and Improving Performance that Matters in Higher Education. *EDUCAUSE Review* 43*(*1): 42–67, 2008. http://connect.educause.edu/Library/EDUCAUSE+Review/ActionAnalyticsMeasuringa/45825.
8. **Villano, M.** Student Lifecycle Management: CRM Meets the Campus. *Campus Technology, 2007*. http://campustechnology.com/articles/45191/.
9. **Abdous, M. and W. He.** Streamlining Forms Management Process in a Distance Learning Unit. *Journal of Distance Learning Administration* 10(2): 2007. http://www.westga.edu/~distance/ojdla/summer102/abdous102.htm.
10. **Allen, I. E. and J. Seaman.** *Online Nation: Five Years of Growth in Online Learning.* The Sloan Consortium, 2007. http://www.sloan-c.org/publications/survey/pdf/online_nation.pdf.
11. **Maguire, L.** Literature Review – Faculty Participation in Online Distance Education: Barriers and Motivators. *Journal of Distance Learning Administration* 8(1): 2005. http://www.westga.edu/~distance/ojdla/spring81/maguire81.htm.
12. **Hammer, M. and J. Champy.** *Re-Engineering the Corporation, a Manifesto for Business Revolution*. New York: Harper Collins, 1993.
13. **Penrod, J. and M. Dolence.** Reengineering: A Process for Transforming Higher Education. *Professional Paper Series* (9): 1992. http://www.educause.edu/Resources/ReengineeringAProcessforTransf/160403.
14. **O'Neill, P. and A. Sohal.** Business Process Reengineering a Review of Recent Literature. *Technovation* 19(9): 571–581, 1999.
15. **Davenport, H. and E. Short.** The New Industrial Engineering: Information Technology and Business Process Redesign. *MIT Sloan Management Review* 31(4): 11–27, Summer 1990.
16. **Macintosh, R.** BPR: Alive and Well in the Public Sector. *International Journal of Operations & Production Management* 23(3): 327–344, 2003.
17. **Ahmad, H., A. Francis and M. Zairi.** Business Process Reengineering: Critical Success Factors in Higher Education. *Business Process Management Journal* 13*(*3): 451–469, 2007.
18. **Abdous, M. and W. He.** A Framework for Process Reengineering in Higher Education: A Case Study of Distance Learning Exam Scheduling and Distribution. *The International Review of Research in Open and Distance Learning* 9(3): 2008. http://www.irrodl.org/index.php/irrodl/article/view/535/1138.
19. **den Hengst, M. and G. de Vreede**. Collaborative Business Engineering: A Decade of Lessons from the Field. *Journal of Management Information Systems* 20(4): 85–114, 2004.
20. **Greenwood, R. and R. Hinings.** Understanding Radical Organizational Change: Bringing Together the Old and the New Institutionalism. *Academy of Management Review* 21(4): 1022–1054, 1996.
21. **Kohli, R. and E. Hoadley.** Towards Developing a Framework for Measuring Organizational Impact of IT-Enabled BPR: Case Studies of Three Firms. *SIGMIS Database 37(*1): 40–58, 2006. http://doi.acm.org/10.1145/1120501.1120505.
22. **Robinson, R.** *Radical Systems Development: An Introduction to Rapid Application Development*. Chapel Hill, NC: Professional Press, 1995.
23. **Hartman, J., C. Dziuban and P. Moskal.** Faculty Satisfaction in ALNs: A Dependent or Independent Variable? *Journal of Asynchronous Learning Networks* 4(3): 2000. http://www.sloanconsortium.org/publications/jaln/v4n3/v4n3_hartman.asp.
24. **Shea, P., A. Pickett, and W. Pelz.** A Follow-Up Investigation of "Teaching Presence" in the SUNY Learning Network. *Journal of Asynchronous Learning Networks* 7(2): 61–80, 2003. http://www.sloanconsortium.org/publications/jaln/v7n2/v7n2_shea.asp.
25. **Grant, M.** Learning to Teach with the Web: Factors Influencing Teacher Education Faculty. *Internet and Higher Education* 7(44): 329–341, 2004.
26. **Moore, J.** A Synthesis of Sloan-C Effective Practices. *Journal of Asynchronous Learning Networks* 9(3): 55–73, 2005. http://www.sloanconsortium.org/publications/books/v9n3_moore.pdf.
27. **Abdous, M. and W. He.** Streamlining the Online Course Development Process by Using Project Management Tools. *Quarterly Review of Distance Education* 9(2): 181–188, 2008.

VIII. ABOUT THE AUTHOR

M'hammed Abdous, Ph.D., is Assistant Vice-President for Teaching and Learning with Technology at Old Dominion University. His research interests include distributed learning trends, process reengineering, E-learning, and quality assurance.

Wu He, Ph.D., is Instructional Technologist at the Center for Learning Technologies at Old Dominion University. His research interests include information seeking and learning technologies.

FROM POSTS TO PATTERNS: A METRIC TO CHARACTERIZE DISCUSSION BOARD ACTIVITY IN ONLINE COURSES

Catherine A. Bliss and Betty Lawrence
Center for Distance Learning
Empire State College

ABSTRACT

Asynchronous text based discussion boards are included in many online courses, however strategies to compare their use within and between courses, from a disciplinary standpoint, have not been well documented in the literature. The goal of this project was to develop a multi-factor metric which could be used to characterize discussion board use in a large data set (n=11,596 message posts) and to apply this metric to all Mathematics courses offered in the January 2008 term by the Center for Distance Learning at Empire State College. The results of this work reveal that student participation rates, quantity of student posts, quality of student posts and the extent of threading are well correlated with instructor activity.

KEYWORDS

Distance Learning, Discussion Board, Asynchronous Learning, Student Participation, Instructor Roles, Educationally Valuable Talk, Metric, Mathematics, Online Learning

I. BACKGROUND

Online learning programs have grown tremendously in the past 15 years. As these programs continue to grow, research in the areas of instructional design and course evaluation have also grown. One area of online course design, delivery and evaluation that has received a particularly high level of attention is the use of asynchronous text based discussion. Providing a framework for the purpose of discussion boards in an online course, Garrison, Anderson and Archer's [1] model of "Communities of Inquiry" for online learning environments place student learning at the intersection of social, cognitive, and teaching presence. This model has been extended [2, 3] by overlaying interaction with peers, interaction with content and interaction with instructors with social, cognitive and teaching presence, respectively. At the core of this extended model are Chickering and Gamson's "Seven Principles for Good Practice in Undergraduate Education" [4].

A. Social presence

Social presence has been defined as "the ability of learners to project themselves socially and affectively into a *community of inquiry*" [5, p. 50]. As such, discussion boards are a place where learners can engage themselves socially and the class may develop a sense of community [6, 7]. For adult learners who may not have the traditional support networks that younger students may have, and for distance learners, who are separated by time and physical space, the development of peer support networks via discussion boards within an online course may be particularly important.

Research with students in the State University of New York's s Learning Network supports the notion

that students benefit from this social interaction in online courses. Researchers [8, 9] found a positive correlation between students' perceived learner-learner interactions and students' satisfaction with their online course. These authors also found positive correlations between students' perceived learner-learner interactions and their perceived learning. This suggests that building the social presence and encouraging learner-learner interactions may be one way in which discussion boards enhance the online learning experience.

B. Cognitive Presence

Discussion boards can be used to facilitate students' co-construction of knowledge, engagement in higher order thinking, and the development of critical thinking skills [10, 11, 12]. Discussion boards can be a place where students negotiate meaning of course content and practice skills before independent mastery is expected.

Constructivist learning theory suggests that knowledge is constructed by learners, rather than transmitted from teacher to student. According to Vygotsky's Social Learning Theory, learning occurs through students' social interactions [13]. The Zone of Proximal Development is defined as the zone between the abilities which students can perform independently and those which require the guidance of an instructor. Vygotsky concluded that this is where learning occurs. This theory suggests that discussion boards may be an opportunity where students may bridge the gap between existing skills and new skills to be acquired.

Discussion boards also enhance student learning in an online course because they are an area where higher order cognitive processing may be developed. In 1956, Benjamin Bloom described six of levels for higher order cognitive processing and suggested that engagement in the higher levels would allow a greater transfer of learning beyond the course context [14]. Students may often operate in the first three levels of cognitive processing (knowledge, comprehension and application) via individually based homework assignments, projects, and assessments. However, it is a more challenging task to engage students in the upper three levels (analysis, synthesis and evaluation). It is precisely through class discussions that students may argue, evaluate, assess, construct, design, propose, compare and analyze course content. "Electronic discussion changes the focus of the learning process, replacing the single view of the instructor with the diversity of views from different students" [10, p. 41]. It is within these levels where a deeper understanding of course content can be cultivated, thus allowing students to "package and bundle" course content to be used in their professional and personal lives. Thus, discussion boards in an online course may be a place where students can engage in higher order thinking.

Discussion boards have a role in teaching critical thinking skills. As an instructional tool, they can encompass the best elements of writing assignments and in class discussions [10]. In an online course, an asynchronous text-based discussion board may hold the added advantage of a time-lag between postings. This may lead to greater reflection and enriched discussions as compared to discussions in face-to-face settings [15, 16].

Several authors have found support for the theory that discussion board use may support cognitive processing. Work by [2, 8,9, 17] indicates significant positive correlations between perceived discussion board activity and perceived learning. Even more convincing, [17] and [18] found a significant positive correlation between the quantity of student posts and students' scores on final assessments. It is possible that students with particularly good study habits, post frequently to the course and also work efficiently to master course objectives, thus scoring well on final assessments. At the very least, though, discussion boards can support cognition through peer-dialogue and increased learner-content interactions.

C. Teaching Presence

Teaching presence in online courses can be defined as consisting of three roles: "design and organization, facilitating discourse, and direct instruction" [19, p. 1]. Instructors may use several strategies for facilitating discourse, such as "identifying areas of agreement/disagreement, seeking to reach consensus and understanding, encouraging, acknowledging, and reinforcing student contributions, setting the climate for learning, drawing in participants and prompting discussion, and assessing the efficacy of the process" [19, p. 8]. Discussion boards are a place where instructors may facilitate discourse and provide instruction. Instructors may select content and re-focus a discussion that may have diverged from the main topic. Instructors may also set a tone which respects the diversity of ideas, opinions and experiences and which models an appreciation for the love of learning. As such, instructors need to be present in discussions and discussion boards are a place where teaching presence may be demonstrated.

The role of the instructor in facilitating online discussion has been discussed widely in the literature [8–10, 18–23]. Surprisingly, considerable debate exists in the literature about the role of an instructor in facilitating online discussion. On one side of the debate, there is the belief that the instructor is crucial to facilitating discussion, but should do so without taking over the discussion [7–10, 20, 23]. Some researchers [10] suggest the role of the instructor is to be a "guide on the side," limited to maintaining focus, moving the discussion along and prompting students to reflect on the discussion. In studies examining discussion board activity, [20] and [21] found that "faculty responsiveness" was a salient factor in developing a meaningful online discussion. However, "more is not necessarily better in terms of presence" [21, p. 143]. Instructors who respond too quickly or extensively may shutdown student interaction.

The view that instructors should be active on discussion boards is supported by researchers examining student satisfaction and perceived learning in online courses. Positive correlations have been found between a.) perceived learning and perceived instructor-student interaction [8, 24], b.) the quantity of instructor postings and the quantity of student postings [9], and c.) students' perceived level of interaction with instructors and overall satisfaction for courses [24]. Other researchers [3, 25] have found that the extent to which instructors are perceived to facilitate discussion is correlated with students' satisfaction of online courses and reported learning.

On the other side of the debate is the view that instructors can interfere with student dialogue and actually inhibit discussion quality rather than facilitate it [22, 23]. Although one researcher [22] suggests that instructors' posts can actually shut down discussion between students, this analysis is ad hoc and involves only a single case study. No transcript analysis is included in the report and it is not possible to determine if it is the type, rather than the quantity of instructor posts that may be correlated with less dialogue. The conclusions drawn by [23] are also problematic. These researchers found that high percentages of instructor posts were correlated with low quantities of student posts and concluded that instructors may be "shutting down" discussions. This index is problematic because in the case of large numbers of student posts, the percentage of instructor posts would be small, simply because the total number of posts is large. Thus, the need for a new measure is apparent.

II. DEVELOPING A METRIC FOR ASSESSING DISCUSSION BOARD ACTIVITY

Several researchers have suggested methods for measuring discussion board activity. Some have suggested multi-factor metrics [18, 21, 26–28], while others have specifically focused on participation [23, 29, 30], the role of instructors [3, 19, 23, 26], quantity of student posts [17, 18, 32], the quality of

discussion [11, 28, 33–35], the discussion board prompt [36–39], guidelines posted by the instructor [40] and feedback [7, 44].

One of the difficulties in measuring discussion board activity revolves around the multitude of factors which may affect discussion board activity (i.e. course design, instructional approach, learner specific characteristics). The other difficulty often revolves around the need for detailed and comparable results. Most of the work presented in the literature thus far has focused on a single case study or a small handful of courses, analyzed in a cross case study analysis [21]. The goal of this paper is to propose a discussion board metric and to apply this metric to online course offerings in one discipline. This work is valuable in that most of the metrics reported in the literature have dealt with data sets on the order of 1000 message posts or less. The metric described in this paper was applied 11,596 message posts and thus can serve as a tool to analyze differences between courses and between sections of the same course.

A. Student Participation

For this paper, participation is defined as *the percent of enrolled students who decide to post to a discussion board.* Participation rate is an important measure to include in designing a discussion board metric and is distinct from the quantity of student posts. In an ideal setting, all students who enroll in an online course will complete the course and all currently enrolled students will engage in all learning activities. In practice, this is not the case. Thus, it is informative to examine participation rates, both within a course and between courses.

This definition is an improvement over previous attempts to quantify participation. Many authors use quantity of posts and participation interchangeably. This blurs the distinction between the proportion of student using the discussion board (participation) and how "vocal" students are once they decide to participate (quantity). By examining participation rates, it may be possible to identify areas in need of revision.

B. Quantity of Student Postings

The quantity of student posts is a common and usually straightforward measure to gather from learning management system software. One approach, as demonstrated by [21] in a cross case study approach, uses the mean number of messages per forum as an indicator for the quantity of posts. Although this measure is useful in a small case study analysis, this index could be misleading in comparing a large number of courses. For example, a mean value of twelve messages per forum could represent very different quantities of posts, depending on whether these posts were made by twelve students or four students.

Another approach for measuring quantity of student postings is to calculate the number of student responses divided by the number of students in the course [9, 17, 23, 31, 32]. Although this index standardizes quantity of posts by course size, it is misleading in that not all enrolled students choose to participate in every discussion. The index for quantity of student posts could be improved by using the "active" students in a discussion board rather than enrolled.

C. Quality of Student Postings

Two broad strategies of tools to examine the quality of student postings exist in the literature: rubrics and content analysis. Rubrics are often included in a course to define the expectations for high quality

discussion board participation. Several examples of discussion board rubrics exist in the literature [7, 27, 33, 36]. Content analysis is a method of coding the content of discussion board postings and is most useful for studying patterns of interactions for research purposes. Several methods for content analysis have been presented in the literature [15, 32, 34, 35, 40, 46].

Using these frameworks for assessing quality of discussion transcripts is problematic because of the amount of time needed to score a large number of discussion posts and issues of inter-rater reliability should more than one rater be used. For example, in this study, 335 message boards were analyzed. To apply a detailed coding scheme would have required two researchers working full-time (40 hours/week) for approximately a year and a half. Most departments who wish to conduct a program review do not have these sorts of resources to allocate. Inter-rater reliability can also cause problems in producing reliable data in discussion board analysis [38].

Attempts to define the "quality" of student posts through a broader lens do not lend themselves well to course review and supervision. For example, [26, p. 266] defines quality of student posts as "the extent to which the message covers the topic that the course experts have identified as significant and the depth (granularity) to which the topics have been explored." This definition is highly subjective and is difficult to quantify. Another attempt, made by [18] defines quality as clear or unclear. Problematically, a post may be clear, but clearly off-topic. Thus, the use of a new paradigm for "quality" is proposed here for inclusion in a multi-factor metric.

A more useful distinction of "quality" posts can be made by determining whether a post is educationally valuable or educationally less valuable. Educationally valuable talk (EVT) is defined by

"a particular interaction pattern in online discussion threads characterized as dialogic exchanges whereby participant collaboratively display construction, and at times, critical engagement with the ideas or key concepts that make up the topic of an online discussion, and build knowledge through reasoning, articulations, creativity and reflection" [43, p. 402].

EVT is characterized by seven indicators: exploratory, invitational, argumentational, critical, heuristic, reflective, or interpretive [43]. Educationally less valuable talk (ELVT) may be defined as "talk that lacks substance in regard to critical and meaningful engagement with the formal content or ideas that are discussed in the posts of other in an online discussion" [43, p. 404]. ELVT is characterized by five indicators: affective, judgmental, experiential, reproductional, or miscellaneous [43]. It is worth noting that educationally less valuable talk is still valuable. It may help build the online community and establish trust within the class. From an instructional and supervision standpoint, this paradigm presents an efficient way to classify posts as related to course content and which move the discussion forward (EVT) vs. those posts that are either not related to course content or those which add little to the depth or breadth to the discussion.

Although EVT/ELVT classification scheme contains 12 indicators and 15 sub-indicators, the main classification scheme represents one choice: EVT or ELVT. The distinction between EVT and ELVT is clear and intuitive. Coding discussion board transcripts using this scheme requires one researcher approximately 1 hour to code approximately 72 posts. Thus, depending on the length of the discussion, the coding time for one discussion board may range from 30 minutes to 2 hours. It is evident that more authentic methods of measuring posts' perceived educational value exist (i.e. interviews, journaling), however, the intention here is to assess the percentage of the message posts which address educationally valuable talk (i.e. talk related to the educational content and objectives of the discussion prompt). The goal here is not to make claims about the inherent value of the posts as evidence of learning, but rather to

provide a metric which can measure the percentage of the discussion which was related to the educational nature of the discussion.

D. Extent of Threading

Increased threading represents an original post which has generated increased dialogue. In addition to quantifying the participation rate and the quantity and quality of student posts, the pattern of interaction can provide additional insights into how discussions are being used in a course and how they may be improved.

A common measure of threading is average thread length [18, 21, 23]. The average discussion thread length is calculated by the total number of student postings divided by the total number of discussion threads. This index tends to blur the distinction between posts that are unanswered, posts that are acknowledged and those which result in discussion because it is reported as an average. "Message maps" are another way to analyze interaction patterns [44, 45]. Although this is interesting from an interaction pattern analysis standpoint, it is not appropriate for use in course review and comparing courses to each other. A more useful method of characterizing discussion would be three broad categories: unanswered posts, acknowledged posts, and posts which lead to discussion. Knowing the relative amounts of posts in these distinct categories would provide useful information on how much dialogue occurs within a course.

E. Instructor Presence

In studies where multiple courses and instructors have been compared, instructor presence has been generally characterized by the quantity of instructor posts and/or the nature of the instructor's posts. Problematically, though, only measuring the number of instructor posts on a discussion board can be misleading. For example, an instructor with four posts on a discussion board with four participating students represents and hence a minimum of four student posts represents a very different level of instructor activity than an instructor with four posts on a discussion board with twenty-five participating students and a minimum of twenty-five student posts. In the former case, the instructor is highly present and in the latter, the instructor is faintly present. One approach has been to categorize instructor presence as high, medium or little or no presence, although these classifications are not well defined [21]. Characterizing the nature instructor presence by other researches is similarly problematic as it is narrative or descriptive in nature [18, 22]. Part of the reason for this is that often, one course taught by the researcher forms the basis of the research study.

Another approach has been to examine the percentage of instructor postings as defined by the number of instructor postings/total number of postings [23]. This index is problematic because in the case of large numbers of student posts, the percentage of instructor posts would be small, simply because the total number of posts is large. Thus, this index for instructor quantity is confounded with student quantity and not useful for discerning correlative relationships between these two variables. An improvement over this measure has been to measure instructor participation as the raw count of instructor responses per enrolled student in the course [9]. Since not all enrolled students participate in every discussion board, an improved measure would be to use "participating students" rather than enrolled students.

F. Expectations & Guidelines

Communicating clear expectations sets students up for success [4]. Clear guidelines become even more important in an online course than in a face to face course because of the lack of immediate feedback to students. In a face to face setting, an instructor may provide cues such as eye contact, nods of approval or

question the student to provide additional information to support their views. Without these cues in an online course, the initial guidelines and subsequent feedback become increasingly important in facilitating quality academic discourse. Failure to include clear guidelines obscures the definition of successful participation in an online course and essentially, denies the opportunity to succeed to those who do not possess this coveted knowledge of expected behavior.

Defining expectations becomes even more important in working with students who have had little or no experience with discussion board activity. Research with undergraduate students [15] suggests that taking an instructional approach to forum posting in the first learning module may help inform students of discussion expectations. This approach may also work well for adult learner populations, many of whom are returning to the academic setting after years of professional experience,

In practice, clear guidelines can improve student outcomes. A positive correlation was found between stated guidelines for discussion posting and students perceived learning in SUNY's SLN [9]. Other researchers, such as [21], report that courses whose instructors who did not post clear guidelines on the length, quantity and content of posts resulted in discussions that lacked academic quality. In these cases students' posts floundered and consisted mostly of asking for help on other parts of the course. Other researchers [40] have found that increasingly detailed guidelines and structure were correlated with increased threading and interaction. These researchers also found that increasingly detailed evaluation guidelines and the presence of a rubric were correlated with increased numbers of posts per student.

G. Presence of Feedback

According to the Chickering and Gamson's *Seven Principles for Good Practice in Undergraduate Education*, good practice involves providing feedback to guide student learning [4]. Other researchers [10] suggest that meaningful discussion can be effectively facilitated by grading discussion activity.

In practice, several researchers report found that the use of the course grades is positively correlated with discussion board activity. In courses where feedback was "timely and substantive" there were higher levels of dialogue [21]. In courses where discussion boards were not assessed (no numerical or letter grade), there were many non-participating students throughout the semester [21]. However, in courses where only quantity of posts was measured, the quality of posts did not meet instructors' expectations [21]. According to [9], grade weight for discussion is positively correlated with students' quantity of posts, perceived learning and perceived student-student interaction. Other researchers report that courses with a graded discussion board have significantly higher quantities of student posts than courses that do not [46]. Interestingly, the work of [24] indicates a positive correlation between the percentages of the course grade derived from discussion participation with student satisfaction, perceived learning, perceived interaction with the instructor and perceived interaction with their peers.

III. METHODS

Fourteen online undergraduate Mathematics courses (33 course sections) offered by the Center for Distance Learning at Empire State College were observed for the entire duration of their delivery. Courses were delivered over a 15 week semester, beginning in January 2008. Each discussion board, in addition to course syllabi, private folders and grade book were observed during this time period. The result was an analysis of 11,596 posts made over 335 message boards. Only course discussion boards were analyzed. Not included in the analysis were the Ask a Question Board, Student Lounge and the Icebreaker discussion. Small group discussions were included in the analysis, however discussions used

as laboratory workspaces (i.e. gathering data and preparing a report) were not included. The distinction between these two items was made based on whether the goal was discussion (included) or to prepare a lab/homework report (not included). Discussion boards were observed and quantified two weeks after their due date to capture late posting students' contributions.

A. Student Participation

Student participation was calculated by the number of students participating in a message board, divided by the number of students enrolled in the course as the time of the message board.

$$Student\ participation\ = \frac{\#\ of\ students\ participating\ in\ discussion}{\#\ of\ students\ enrolled\ in\ the\ course}$$

B. Quantity of Student Postings

The quantity of student posts for each discussion board was calculated as the number of student posts on a message board, divided by the number of students participating in the message board.

$$Quantity\ of\ student\ posts = \frac{\#\ of\ student\ posts}{Students\ participating\ in\ the\ discussion}$$

This gave an indication of how many posts students were making on discussion boards and in the course overall, when they chose to participate.

C. Quality of Student Postings

Transcript analysis was conducted to assess the quality of posts. Student and instructor posts were codes as Educationally Valuable Talk (EVT) or Educationally Less Valuable Talk (ELVT) according to the definitions set forth by [47]. The percent of educationally valuable talk was calculated by dividing the number of EVT posts by the total number of posts.

$$Quality = \frac{\#\ of\ EVT\ posts}{total\ \#\ of\ posts}$$

D. Extent of Threading

For the purposes of this study, three conversation styles were defined (Fig. 1). The "speak" style was defined by an original post to which there was no reply. The "speak-reply" style was defined by an original post which receives only one reply or several replies only one layer deep. The "discuss" style was defined by an original post, which contained replied at least two layers deep.

Conversation Style	Example
Speak	Math is Great…Posted by Mary
Speak-reply	Math is Great…Posted by Mary Re: Math is Great…Posted by Bob Re: Math is Great…Posted by Cindy

Discuss	Math is Great…Posted by Mary Re: Math is Great…Posted by Bob Re: Math is Great…Posted by Mary Re: Math is Great…Posted by Cindy

Figure 1. Conversation Style Categories

E. Instructor Presence

The quantity of posts made by an instructor to a discussion board was divided by the number of active students. This was done in order to facilitate comparisons between classes with different enrollments. It was decided the participating students was a more accurate measure of how "response" instructors were to student posts.

$$Instructor\ presence = \frac{\#\ of\ instructor\ posts}{\#\ of\ students\ participating\ in\ discussion}$$

G. Expectations & Guidelines

The course syllabi and discussion board directions were examined for evidence of guidelines regarding the quantity and quality of posts students should make. Guidelines were scored as present (1) or absent (0).

H. Presence of Feedback

The course grade book and private folders for students were examined to reveal evidence of discussion board evaluation. Evaluation of students' discussion board posts via email was not included because it was not possible (nor desirable) to search faculty email accounts for this information. Evaluation was scored as present (1) or absent (0).

IV. RESULTS

The results in this paper describe overall trends exhibited by the thirty three course sections. Further analysis which compares multiple sections of the same course or multiples courses taught by an instructor could be conducted, but are beyond the scope of the results presented and discussion in this paper.

A. Participation

Participation in discussion boards varied between courses and between different sections of the same course (Fig. 2). The proportion of enrolled students who participated in discussions, averaged for each course section (n=33) ranged from .94 to .40. Using Pearson's Correlation Coefficient, a significant positive correlation was found between participation and the instructor presence ($p<.01$). Similarly, a significant positive correlation was also found between with presence of feedback ($p<.001$) and with guidelines describing instructor expectations for quality posts ($p<.01$).

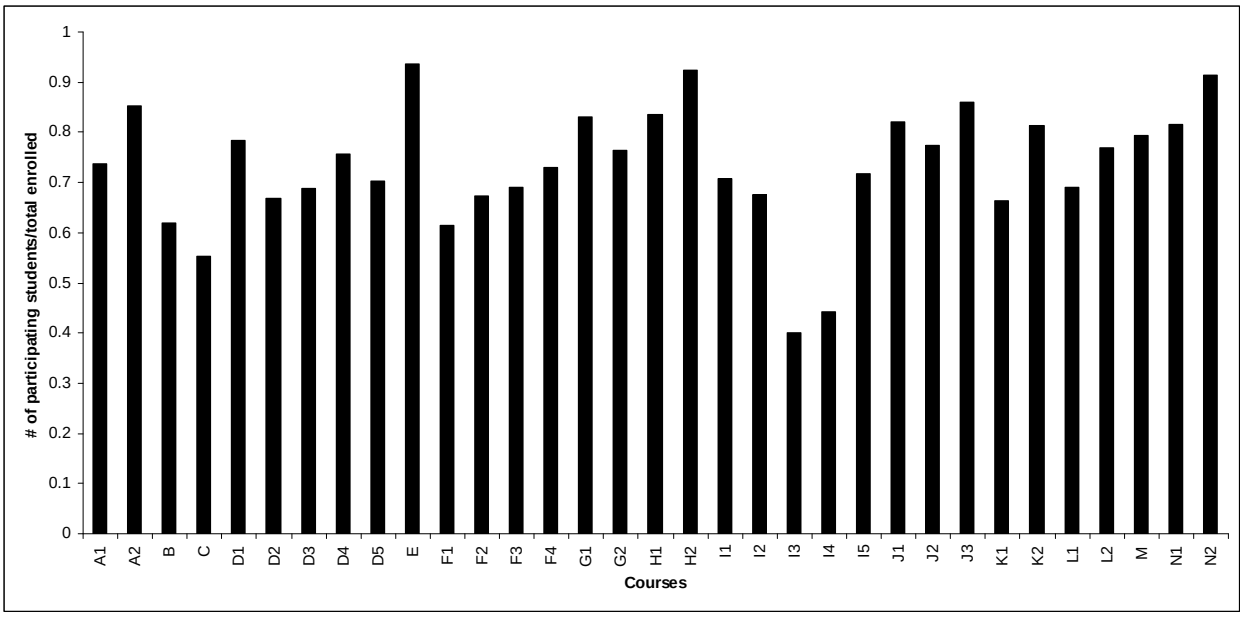


Figure 2. The Proportion of Students Participating in Discussion Boards. Courses are Designated by Letters and Course Sections are Designated by Numbers. For example, G1 Represents Section 1 of Course G.

B. Quantity of Student Postings

The quantity of student posts varied from a low of 1.424 messages/participating student to a high of 4.75 messages/participating student. There were considerable differences both between courses and between different sections of the same course (Fig. 3). Pearson's Correlation coefficient revealed a significant positive correlation between the quantity of student posts was positively correlated with instructor presence ($p<.05$), with presence of feedback ($p<.01$) and with guidelines describing instructor expectations for quality posts ($p<.001$). Interestingly, the quantity of student posts was not correlated with the presence of guidelines describing the expectations for quantity of posts.

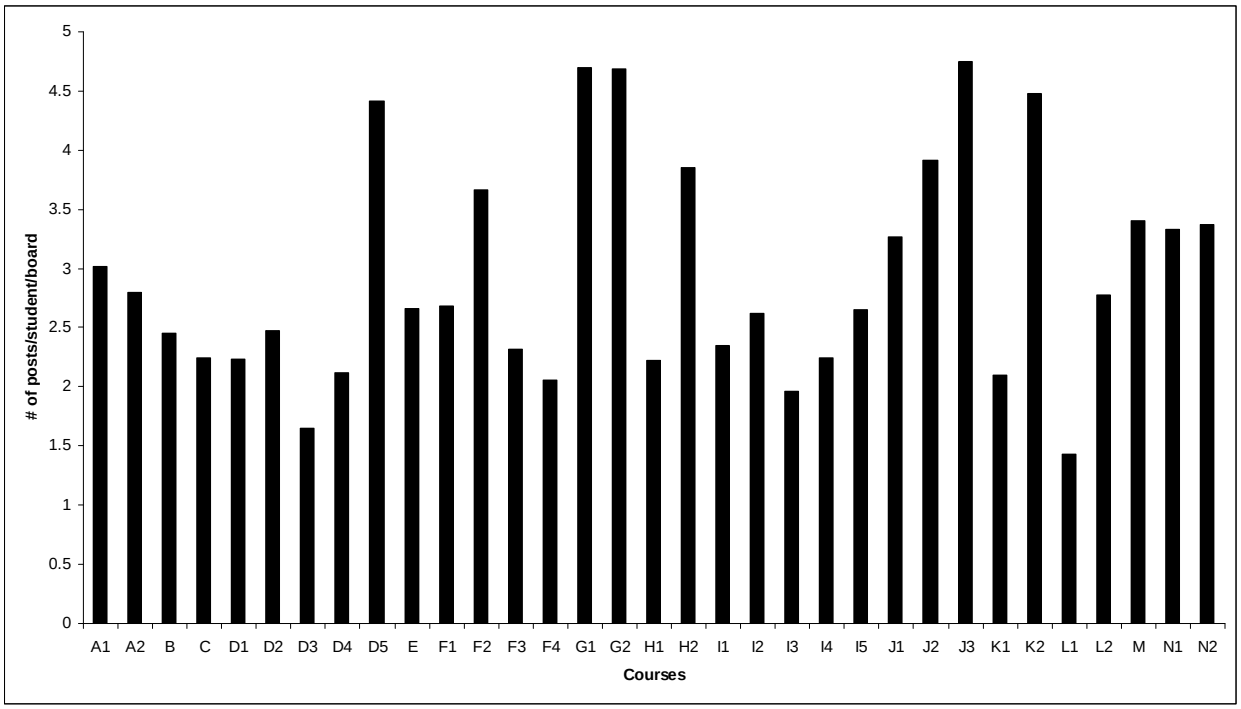


Figure 3. The Average Number of Posts per Participating Student per Discussion Board.

C. Quality of Student Postings

The proportion of the total posts that contained educationally valuable talk varied from a low of .27 to a high of .78 (Fig. 4). Quality was positively correlated with presence of feedback ($p<.025$). Quality of student posts was not correlated with instructor presence or guidelines for quality or quantity.

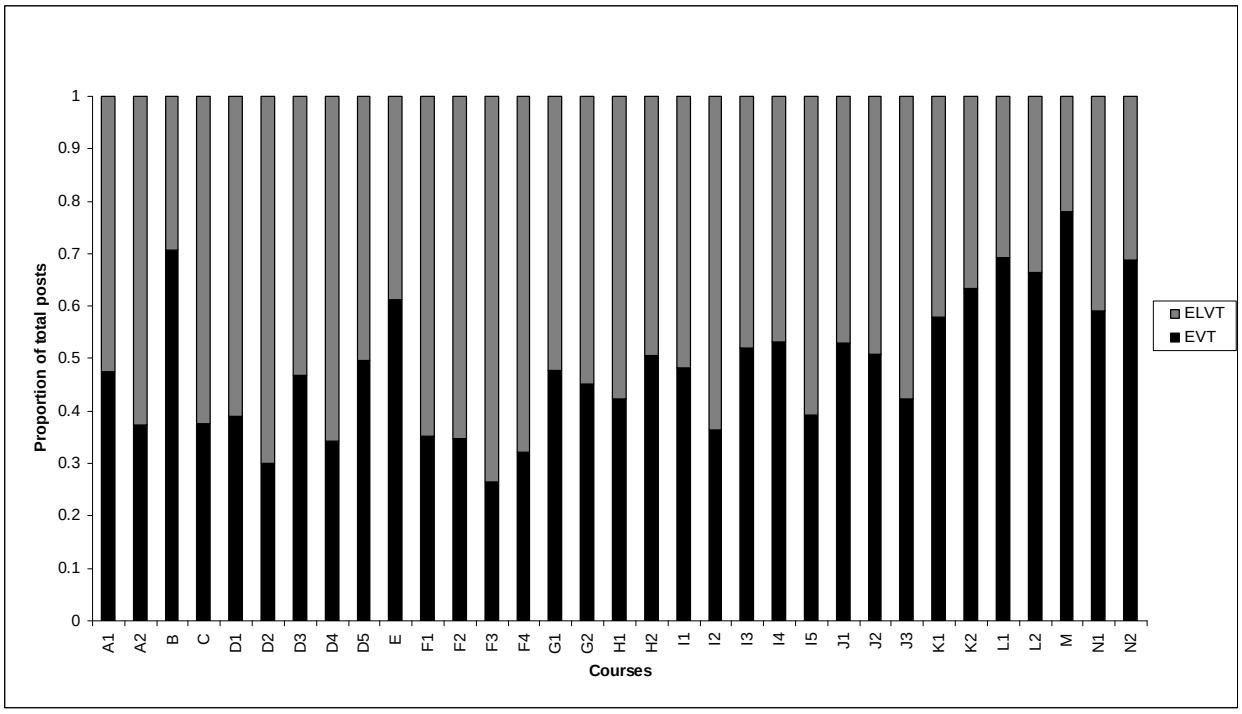


Figure 4. Quality of Posts was Determined by Criteria Set Forth by Uzuner's EVT/ELVT Criteria [43].

D. Extent of Threading

The extent of threading is presented in Figure 5. The percent of initial threads that resulted in a discussion was positively correlated with instructor presence ($p<.05$), with Evaluation (use of grade book) ($p<.05$) and with guidelines describing instructor expectations for quality posts ($p<.05$). The percent of 'speak' posts was negatively correlated with the responsiveness of instructor posts ($p<.05$), with guidelines describing instructor expectations for quantity posts ($p<.025$) and with guidelines describing instructor expectations for quantity posts ($p<.05$).

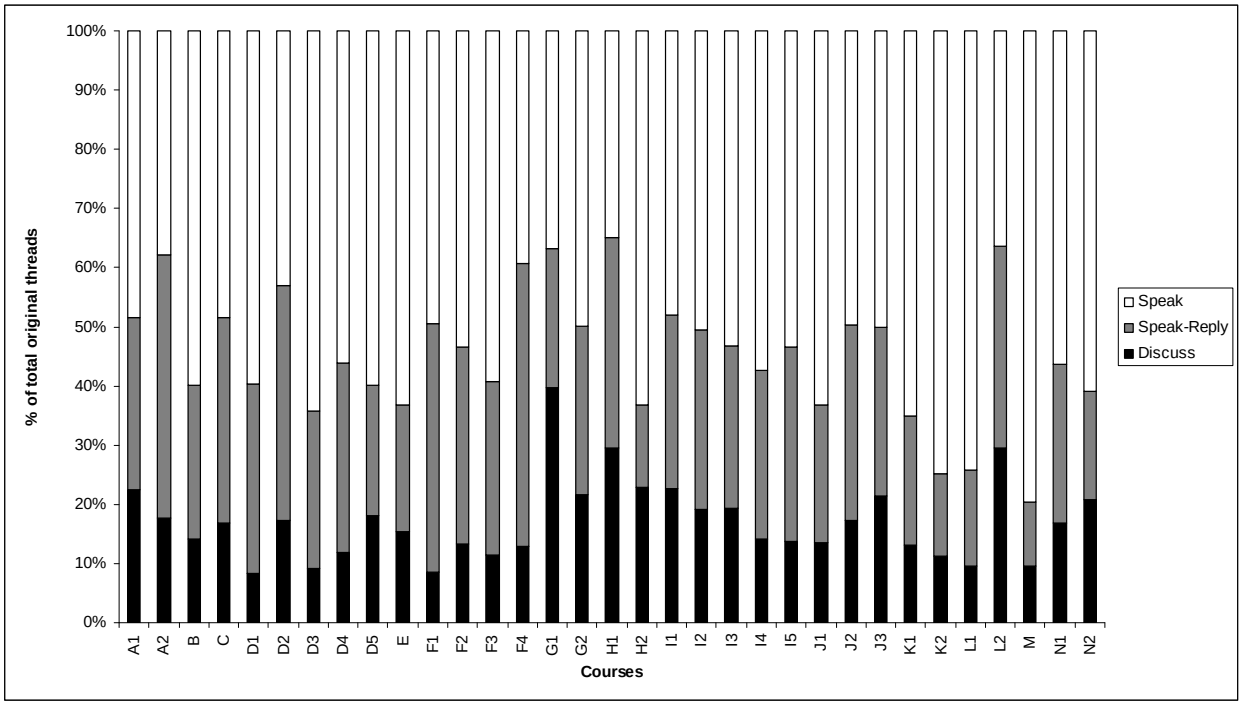


Figure 5. The Percentage of Conversation Style on Discussion Boards

E. Instructor Presence

Instructors varied in their approach to discussion boards (Fig. 6). Some instructors were very responsive, such as G1 with an average responsiveness of 2.62 messages per participating student. Other instructors hardly posted during the entire semester. For example, J2 posted only 1 message during the course (.01 messages/student).

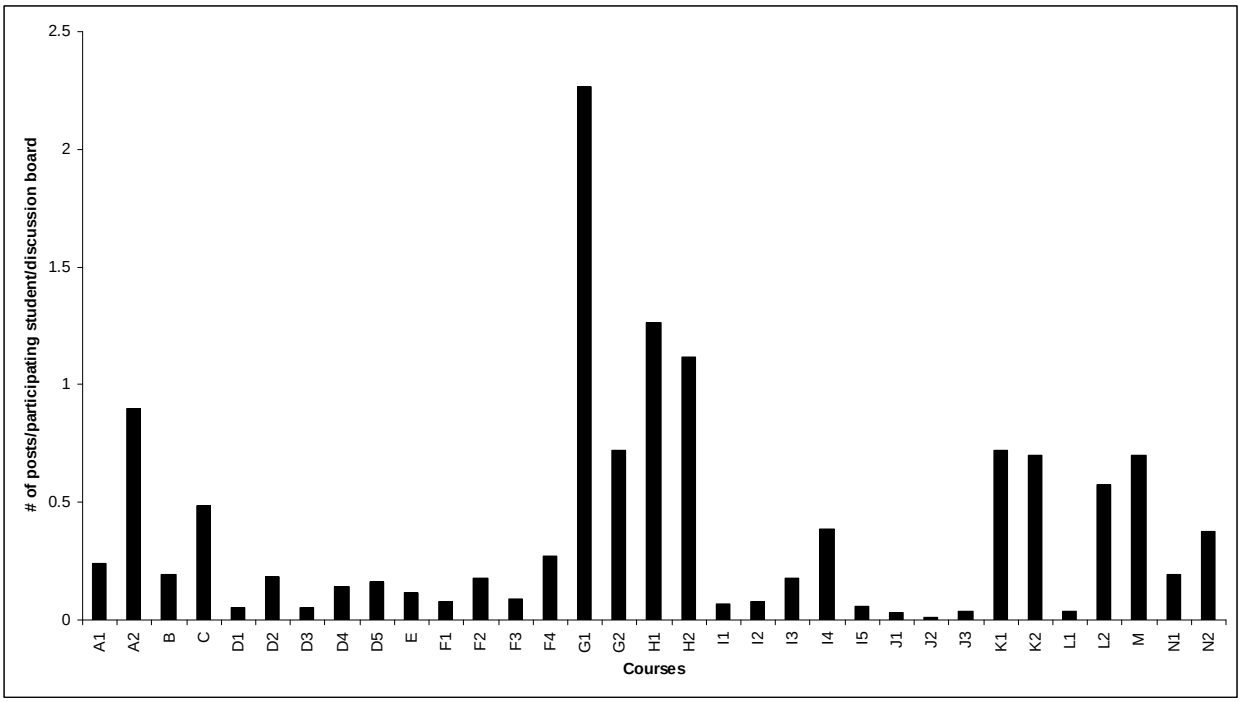


Figure 6. Instructor presence as determined by the number of instructor posts per participating student.

F. Expectations & Guidelines

Seventy-nine percent of CDL Mathematics courses contained guidelines for the number of student posts. In 52% of these courses, the standard was set to 1 original post and 2 replies.

Only 27% of courses contained guidelines for what is meant by a quality post. These guidelines usually addressed the presence of critical thinking in the post and/or providing substantive content that could increase understanding of the subject matter. One course contained a discussion rubric however, it was not used.

G. Presence of Feedback

Evaluation of students' discussion board posts was provided in 15 out of 33 course sections. No feedback regarding discussion board posts provided to students in the Private Folders. Thus, the 15 course sections which did provide feedback utilized the grade book as the mechanism for communicating feedback and evaluating student discussion posts.

V. DISCUSSION

In this paper, the development and application of a metric is presented which is suitable for analyzing discussion board use patterns in large data sets. This multi-factor metric provides valuable information for researchers and practitioners. As a tool for research, this metric can be used to analyze discussion board use patterns in large data sets. This provides an advance over previous studies which have typically utilized cross-case study [21] or single case study approaches [18, 22]. For practitioners, particularly course supervisors, this metric may be used to compare discussion board use patterns within a distance learning program's set of online courses.

This study, distinguishes participation from students' quantity of posts. This is an improvement over previous studies which often use these terms synonymously, thus obscuring distinctions between the percent of enrolled students which actually participate in discussions and measures of how frequently students post once they decide to participate. Learning orientation may also play a role in determining which type of learners may engage with and benefit from discussion board activities. In order to engage in mathematical discussions which create knowledge, students must be willing to venture mathematical ideas in a public forum and interested in socially constructing knowledge. Three models suggested by [48] may affect learner's orientation towards engagement in discussion boards. Independent learners typically master concepts through solitary study while interactive learners tend to prefer one-to-one or one-to-many conversations. The collaborative learner may be most likely to engage in shared knowledge building in discussion boards.

Admittedly, this study assumes that discussion participation is synonymous with the decision to post to a discussion board. Some authors have argued that discussion board participation should be more broadly defined to include both posting and viewing behavior. The work of [47] suggests that "hits," rather than discussion board posts are more predictive of students' learning. This is not surprising, however, because highly motivated students may have high login rates, as well as high end of course quiz grades. The work of [29] also suggests that "pedagogical lurking" can result in self-reported learning. Future studies may wish to investigate the role that lurking plays in students' valuation of discussion boards as a learning tool.

Applying the classification of Educationally Valuable Talk (EVT) and Educationally Less Valuable Talk (ELVT) developed by [43] is an improvement over previous rubrics and content analyses for discussion transcripts. Coding discussion posts as EVT vs. ELVT is intuitive and straightforward. Transcript analysis can be conducted efficiently, while still retaining valuable information about the nature of the discussion that took place. Although we may envision a dialogue composed entirely of EVT as desirable, in practice, this is neither realistic nor desirable. ELVT posts that contribute to the development of a learning community, through trust, acknowledgment and empathy may not move a discussion along educationally, but they move the class towards building community [5, 6]. These elements open the doors for future "risk taking" in the course and build a support network for students within the course.

This study proposes a new way of characterizing the extent of threading in threaded discussions. This measure is an improvement over previous attempts to measure interaction patterns. It neither blurs the distinction between unanswered, acknowledged, and discussion-generating posts [18, 21] nor does it involve the use of overly time consuming data analysis tools [44, 45] which can be useful for theoretical research, but impractical for action research. Realistically, in a discussion, some comments may go unanswered. Ideally, the percent of unanswered posts would be as small as possible. In some courses, the percent of unanswered posts was less than 40%. Instructors in these courses posted often to the discussion board and their style of posting often involved affective and supportive comments, followed by probing questioning techniques [49]. In contrast, other instructors who posted often to the discussion boards, but who lacked the warmth and enthusiasm, did not generate the extent of threading seen in other courses.

The results of this paper confirmed what we believe to be best practices in higher education [4]. Student participation, student quantity of posts and extent of threading were positively correlated with instructor presence, presence of feedback and guidelines for quality posts. The measure of quality of posts was correlated with presence of feedback. These results are not surprising, but rather provide further evidence which supports previous studies which suggest that the presence of feedback is an important factor in discussion facilitation [9, 21, 46] as is instructor presence [3, 8, 9, 24, 25] and structuredness [15, 40].

Instructor presence was positively correlated with participation rates, quantity of student posts and discussion threading. These results suggest that instructors who are present, attentive and active in discussion boards can facilitate student participation in discussion forums. The results here do not support the view that increased instructor posts tend to 'shutdown' a discussion [22, 23]. Instead, this finding is similar to the conclusions drawn by [14], who suggested that instructors who demonstrate presence, without taking over the discussion, were able to effectively facilitate discussions. Interestingly, instructor participation was not correlated with the quality of student posts, suggesting that instructor posts do not necessarily function to re-focus or deepen the discussion. In some cases, it was noted that instructors' posts tended to stray off-topic and become more conversational than educational. These findings are consistent with the work of other researchers who found that the majority of faculty posts were those with no academic content (other, administrative, and affective) [20].

Developing rich discussions in online mathematics courses is an area not well represented in the literature. A need exists for discipline specific study, particularly with respect to the learning and teaching of mathematics at a distance. Many students and faculty may be familiar with a transmission model of math instruction. In an online setting, the transmission (direction instruction) model would be equivalent to students reading content, assimilating this content into their cognitive scheme and then performing mathematical tasks with mastery. This model assumes the exposure is sufficient for learning. While some mathematically talented students may be able to learn Mathematics in this way, these students certainly do not make up the majority of undergraduate liberal arts students.

Some researchers have noted that online mathematics courses have higher attrition rates than online courses in other disciplines and that these differences are not mirrored in the face to face setting [50]. These authors suggest that part of the reason for high attrition rates is that the interaction needed to master mathematical skills is missing from asynchronous models of discussion [50]. Other studies have attempted to overcome these difficulties by incorporating synchronous, chat-based, tools [51]. However [52] note that many chat forums lack the tools needed to use mathematical notation, thus providing another obstacle for the learning of mathematics in online discussions. These authors conclude that 'mathematics is not suited for online learning.'

We take a different viewpoint and suggest that capacity for learning management systems to support a greater number of one-to-one and one-to-many communications than in a face-to-face classroom provides an increased opportunity for the communication and learning mathematics. That the challenge for improving mathematical communication, particularly through asynchronous discussion boards, is to first develop tools with which we can measure current use patterns. The development of such tools, such as the metric presented in this paper, hold promise for being able to measure how discussion board use patterns change with particular changes in course structure, teaching style or other parameters targeted for course improvement. Further research that is discipline specific to mathematics will add to the body of knowledge in a relatively undeveloped area of research within online learning pedagogy.

VI. CONCLUSIONS

A multi-factor metric was developed and applied to 33 sections of undergraduate Mathematics courses. The metric quantifies student participation, quantity of student posts, quality of posts, extent of threading, instructor presence, guidelines and presence of feedback. The indices presented here provide a significant improvement over previous studies in their use with large data sets and thus, pragmatic application for researchers and practitioners. This work confirms the results of earlier work which suggest that the presence of guidelines, feedback and instructor presence is correlated with greater student participation, quantity of posts, quality of discussion and extent of threading. Lastly, discussion board use patterns in

online mathematics courses have not been well explored in the literature and further work in this area is encouraged.

V. REFERENCES

1. **Garrison, D. R., T. Anderson, & W. Archer.** Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education* 2(2/3): 87–105, 1999.
2. **Swan, K.** Learning effectiveness online: What the research tells us. In J. Bourne and J. C. Moore (Eds.) *Elements of Quality Online Education, Practice and Direction*. Needham, MA: Sloan-C, 13–45, 2003.
3. **Shea, P. J., A. M. Pickett, & W. E. Pelz.** A follow-up investigation of 'teaching presence' in the SUNY learning network. *Journal of Asynchronous Learning Networks* 7(2): 61–80, 2003. www.sloan-c.org/publications/jaln/v7n2/pdf/v7n2_shea.pdf.
4. **Chickering, A. W. & Z. F. Gamson.** Seven principles for good practice in undergraduate education. *The American Association for Higher Education Bulletin* 39(7): 3–7, 1987. http://honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/7princip.htm.
5. **Rourke, L., T. Anderson, D. R. Garrison & W. Archer.** Assessing Social Presence in Asynchronous Text-based Computer Conferencing. *Journal of Distance Education* 14(2): 50–71, 1999.
6. **Brown, R. E.** The process of community building in distance learning classes. *Journal of Asynchronous Learning Networks* 5(2): 18–35, 2000. www.sloanconsortium.org/publications/jaln/v5n2/pdf/v5n2_brown.pdf.
7. **Rovai, A. P.** A constructivist approach to online college learning. *Internet and Higher Education* 7: 79–93, 2004.
8. **Fredericksen, E., A. Pickett, P. Shea, W. Pelz & K. Swan.** Student satisfaction and perceived learning with online courses: Principles and examples from the SUNY Learning Network. *Journal of Asynchronous Learning Networks* 4(2): 7–41, 2001. www.sloanconsortium.org /publications/jaln/v4n2/pdf/v4n2_fredericksen.pdf.
9. **Jiang, M. & E. Ting.** A study of factors influencing students' perceived learning in a web-based course environment. *International Journal of Educational Telecommunications* 6(4): 317–333, 2000.
10. **Greenlaw, S. A. & S. B. DeLoach.** Teaching critical thinking with electronic discussion. *The Journal of Economic Education* 34(1): 36–53, 2003.
11. **Meyer, K. A.** The ebb and flow of online discussions: What Bloom can tell us about our students' conversations. *Journal of Asynchronous Learning Networks* 9(1): 53–63, 2005. www.sloan-c.org/publications/jaln/v9n1/pdf/v9n1_meyer.pdf.
12. **Muilenburg, L. & Z. L. Berge.** A framework for designing questions for online learning. *DEOSNEWS* 10(2): 2000. www.emoderators.com/moderators/muilenburg.html.
13. **Vygotsky, L. S.** *Mind and society: The development of higher mental processes.* Cambridge, MA: Harvard University Press, 1978.
14. **Bloom B. S.** *Taxonomy of Educational Objectives, Handbook 1: The Cognitive Domain.* New York: David McKay Co Inc., 1956.
15. **Aviv, R.** Educational performance of ALN via content analysis. *Journal of Asynchronous Learning Networks* 4(2): 53–72, 2000. http://www.sloanconsortium.org/publications/jaln/v4n2/pdf /v4n2_aviv.pdf.
16. **Meyer, K. A.** Face-to-Face Versus Threaded Discussions: The Role of Time and Higher-Order Thinking. *Journal of Asynchronous Learning Networks* 7(3): 55–65, 2003. http://www.sloanconsortium.org/publications/jaln/v7n3/pdf/v7n3_meyer.pdf.

17. **Picciano, A.G.** Beyond student perceptions: Issues of interactions, presence, and performance in an online course. *Journal of Asynchronous Learning Networks* 6(1): 21–40, 2002. http://www.sloanconsortium.org/publications/jaln/v6n1/pdf/v6n1_picciano.pdf.
18. **Kay, R. H.** Developing a comprehensive metric for assessing discussion board effectiveness. *British Journal of Educational Technology* 37(5): 761–783, 2006.
19. **Anderson, T., L. Rourke, D. R. Garrison, & W. Archer.** Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks* 5(2): 1–17, 2001. http://www.sloanconsortium.org/publications/jaln/v5n2/pdf/v5n2_anderson.pdf.
20. **Blignaut, A. S. & S. R. Trollip.** Measuring faculty participation in asynchronous discussion forums. *Journal of Education for Business* 78(6): 347–353, 2003.
21. **Dennen, V. P.** From message posting to learning dialogues: Factors affecting learner participation in asynchronous discussion. *Distance Education* 26(1): 127–148, 2005.
22. **Li, Q.** Would we teach without technology? A professor's experience of teaching mathematics education incorporating the internet. *Educational Research* 45(1): 61–77, 2003.
23. **Mazzolini, M. & S. Maddison.** Sage, guide or ghost? The effect of instructor intervention on student participation in online discussion forums. *Computers and Education* 40: 237–253, 2003.
24. **Swan, K., P. Shea, E. E. Fredericksen, A. M. Pickett & W. E. Pelz.** Course design factors influencing the success of online learning. WebNet 2000 World Conference on the WWW and Internet Proceedings. San Antonio, Texas, October 30-November 4th, 2000.
25. **Wu, D. & S. R. Hiltz.** Predicting learning from asynchronous online discussion. *Journal of Asynchronous Learning Networks* 8(2): 139–152, 2004. http://www.sloanconsortium.org/publications/jaln/v8n2/pdf/v8n2_wu.pdf.
26. **Benigno, V. & G. Trentin.** The evaluation of online courses. *Journal of Computer Assisted Learning* 16: 259–-270, 2000.
27. **Hazari, S.** Strategy for assessment of online course discussions. *Journal of Information Systems Education* 15(4): 349–355, 2004.
28. **Roblyer, M. D. & W. R. Wiencke.** Design and use of a rubric to assess and encourage interactive qualities in distance courses. *The American Journal of Distance Education* 17(2): 77–98, 2003.
29. **Dennen, V. P**. Pedagogical lurking: Student engagement in non-posting discussion behavior. *Computers in Human Behavior* 24: 1624–1633, 2008.
30. **Gulati, S.** Compulsory participation in online discussions: Is this constructivism or normalization of learning? *Innovations in Education and Teaching International* 45(2): 183–192, 2008.
31. **Kay, R. H.** Using asynchronous online discussion to learn introductory programming: An exploratory analysis. *Canadian Journal of Learning and Technology / La revue canadienne de l'apprentissage et de la technologie [online]* 32(1): 2008. www.cjlt.ca/index.php/cjlt/article/view/64/61.
32. **Nisbet, D.** Measuring the quantity and quality of online discussion group interaction. *Journal of eLiteracy* 1(2): 122–139, 2004.
33. **Bali, M. & A. R. Ramadan.** Using rubrics and content analysis for evaluation online discussion: A case study from an environmental course. *Journal of Asynchronous Learning Networks* 11(4): 19–33, 2007. http://www.sloanconsortium.org/publications/jaln/v11n4/pdf/v11n4_bali.pdf.
34. **Marra, R. M., J. L. Moore & A. K. Klimczak.** Content analysis of online discussion forums: A comparative analysis of protocols. *Educational Technology Research and Development* 52(2): 23–40, 2004.
35. **Meyer, K. A.** Evaluating online discussions: Four different frames of analysis. *Journal of Asynchronous Learning Networks* 8(2): 101–114, 2004. http://www.sloanconsortium.org/publications/jaln/v8n2/pdf/v8n2_meyer1.pdf.
36. **Christopher, M., J. A. Thomas & M. K. Tallent-Runnels.** Raising the bar: Encouraging higher level thinking in online discussion forums. *Roeper Review* 26(3): 166-171, 2004.
37. **Kramarski, B. & N. Mizrachi.** Online discussion and self-regulated learning: Effects of instructional methods on mathematical literacy. *The Journal of Educational Research* 99(4): 218–231, 2006.

38. **Meyer, K.A.** The method (and madness) of evaluating online discussions. *Journal of Asynchronous Learning Networks* 10(4): 83–97, 2006. http://www.sloanconsortium.org/publications/jaln/v10n4/pdf/v10n4_meyer1.pdf.
39. **Savage, L. B.** Eliciting critical thinking skills through questioning. *Clearing House* 71(5): 291–293, 1998.
40. **Gilbert, P. K. & N. Dabbagh.** How to structure online discussions for meaningful discourse: a case study. *British Journal of Educational Technology* 36(1): 5–18, 2005.
41. **Meyer, K. A.** Does feedback influence student postings to online discussions? *Journal of Educators Online* 4(1): 1–17, 2007.
42. **Benigno, V. & G. Trentin.** The evaluation of online courses. *Journal of Computer Assisted Learning* 16: 260, 2000.
43. **Uzuner, S**. Educationally valuable talk: A new concept for determining the quality of online conversations. *Journal of Online Learning and Teaching* 3(4): 400–410, 2007.
44. **Pena-Shaff, J. B. & C. Nicholls.** Analyzing student interactions and meaning construction in computer bulletin board discussions. *Computers and Education* 42: 243–265, 2004.
45. **Liu, C. C. & C. C. Tsai.** An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity. *Computers and Education* 50: 627–638, 2008.
46. **Rovai, A. P.** Strategies for grading online discussions. *Journal of Computing in Higher Education* 15(1): 89–107, 2003.
47. **Ramos, C. & E. Yudko.** 'Hits' (not 'discussion posts') predict student success in online courses: A double cross-validation study. *Computers and Education* 50: 1174–1182, 2008.
48. **Taylor, J. A.** The evolution of online learning in bridging mathematics at a distance: The tension between learning needs, technological innovation and access restrictions in an Australian Regional University in *Crossing the Bridge* – Proceedings of the 10th Australasian Bridging Mathematics Network, Auckland; UNITEC, pg 67-74, 2002.
49. **Toledo, C. A. "**Does your dog bite?" Creating good discussion questions for online discussions. *International Journal of Teaching and Learning in Higher Education* 18(2):150–154. 2006.
50. **Smith, G. G.** Student attrition in mathematics e-learning. *Australasian Journal of Educational Technology* 21(3): 323–334, 2005.
51. **Loch, B. & C. McDonald.** Synchronous chat and electronic ink for distance support in mathematics. *Innovate* 3(3): 2007. www.innovateonline.info/index.php?view=article&id=374.
52. **Smith, G.G. & D. Ferguson.** Diagrams and math notation in e-learning: growing pains of a new generation. *International Journal of Mathematical Education in Science and Technology* 33(5): 681–695.

INTERNATIONAL CO-TEACHING OF MEDICAL INFORMATICS FOR TRAINING-THE-TRAINERS IN CONTENT AND DISTANCE EDUCATION

Kadriye O. Lewis, Ed.D
Assistant Professor of Pediatrics
Cincinnati Children's Hospital Medical Center

Murat Sincan, MD
Medical Informatics Academic Expert
Hacettepe University Faculty of Medicine
Department of Medical Education and Informatics
Hacettepe Universitesi
Sihhiye, Ankara, Turkey

KEY WORDS
Collaborative Teaching Online, Co-teaching Online, Online Medical Informatics, Course Development, Medical Education

ABSTRACT
In this technologically advanced age, much emphasis is put on collaboration in education at many levels. As a result, faculty co-teaching (collaborative teaching) has grown dramatically. This paper introduces how two instructors from different countries (USA and Turkey), one experienced in online teaching and the other in medical informatics, collaborated successfully, to develop and teach an online medical informatics course. This study outlines effective strategies in co-teaching and student satisfaction with the course and includes various instructional techniques for cost effective technology for communicating at a distance.

I. INTRODUCTION

In education, collaboration has been desirable and valued as an important strategic concept. Most contemporary learning theories argue that the concept of collaboration is one of the cornerstones of social constructivist learning [1]. The social constructivist approach refers to the activities that promote learning through social interaction. In this respect, emphasis is put on collaboration among faculty to work together in a joint intellectual effort or practical endeavor. In a traditional sense, this collaboration would occur within the same institution, department, or discipline. However, new technologies have provided an exciting infrastructure for course delivery allowing accessibility to instruction unbound by time or space. This has created a different educational environment for today's educators to explore new frontiers to interact, collaborate, support, and empower teaching and learning.

As technologies continue to mature and change over time, we will continually explore new concepts, technology tools, and teaching methods. Exploration helps us to understand the strengths and weaknesses of various teaching methods and technology tools; how to use these tools successfully to achieve specific goals; and how to create teaching and learning relationships directly with other educators. Before

technology-powered education, collaborative relationships were difficult to develop due to many factors such as space, time conflicts, power, influence, and professional identity and integrity. However, most educators agree that collaboration is a worthy goal in teaching and learning [2], and because of the complexities of the information age, collaboration has become an essential component of education in the United States [3].

The scope of collaboration can be quite broad within multiple dimensions, including collaboration among instructors, collaboration between students and faculty, simulation environments, electronic books, digital libraries, and virtual universities. As the Internet provides fast connectivity among faculty and students, collaboration online can be easier than in the traditional classroom setting due to real-time issues of space, schedule conflicts, noise, and resources. Instructors residing in different geographic areas can use this modern technology and design a course and co-teach by sharing a course platform such as Blackboard. The two authors of this paper have accomplished a successful instructional collaboration through co-teaching (collaborative teaching), which included on-the-job training of one of the instructors (MS) who had limited experience in online teaching and online pedagogy. Both medical informatics course instructors, each providing their own particular strengths and experiences, provided effective educational experiences to their learners, despite coming from different educational disciplines and working in different countries (U.S. and Turkey). This paper describes our experience developing and co-teaching an online medical informatics course for an Online Master's Degree in Education for Healthcare Professionals program.

II. BACKGROUND INFORMATION

The Online Master's Degree in Education for Healthcare Professionals program was developed as a collaborative project of the University of Cincinnati College of Education (UCCOE) and the UC College of Medicine Department of Pediatrics based in the Cincinnati Children's Hospital Medical Center (CCHMC). The program (http://www.cincinnatichildrens.org/masters) was launched nationally in the fall of 2002 after piloting the program in 1999 and 2001 [4]. The target audience for the master's program is physicians, nurses, and other health professionals with significant teaching responsibilities and interests in medical education and educational research as well as clinical fellows seeking an advanced degree alternative to the more traditional M.P.H. and M.S. degrees. Twelve core courses, 3 credit hours each, plus an elective or independent study, practicum, and master's project, also 3 credit hours each, comprise the 45 credit hour program, The program curriculum is grounded in a pluralistic philosophy that encompasses the many needs of today's medical educator—the science and literature of education, technology skills, and effective application of educational pedagogy and technology—for a diverse population of healthcare professionals. Since the program's inception, 114 students have enrolled in the program, 58 females and 56 males. The mean age of participants is 40 (range 27–64). These students come from different medical and surgical specialties and sub-specialties and from 26 States and three countries (USA, Canada, and Ecuador). Except for one, the core teaching faculty come from UC College of Education and CCHMC. All faculty members have educational credentials such as Ph.D/Ed.D or MD.

A. Medical Informatics

Medical informatics is as diverse and complex a domain as medicine itself. Due to advances in computing and communications technology, medical informatics has become an emerging scientific discipline that addresses the application of computers and information technology to healthcare as well as medical education and biomedical research [5]. Medical informatics allows physicians and other health professionals to integrate advanced information system capabilities with highly trained individuals in clinical medicine. However, because of the developing nature of the field, the distribution of experts around the world is limited and not well balanced geographically, which also tends to limit education in

the field.

In 2005, our Online Master's Degree in Education for Healthcare Professionals program began offering a three-credit-hour medical informatics elective as an alternative to the required three-credit-hour Individual Study. An Individual Study course provides the opportunity for a comprehensive, interdisciplinary educational experience, which allows students broader academic freedom to pursue a project that best suits their individual intellectual interests (or allows them to develop a deep and more complete understanding of complex subject matter under the guidance of a faculty mentor). However, individual studies may not be conducive for some students who are more successful taking a structured course. In our experience with the master's program, most physicians in the program have opted for taking an alternative course rather than developing an independent study project.

The decision to offer the course on medical informatics was made based on an informal needs assessment of the program participants and the availability of a talented academic expert (MS) in the Information Systems Office, Department of Medical Education at Hacettepe University in Turkey. The medical informatics course offered the opportunity to combine the efforts of an experienced online teacher (Kadriye O. Lewis, hereafter referred to as KOL) and an expert in medical informatics (Murat Sincan , hereafter referred to as MS). The co-teaching solution to the course offering thus benefited both the program as a new course offering and the instructor as a means to learn how to teach online.

B. Co-Teaching

The history of co-teaching in the US can be traced back to 1960 when it was advanced by legislated school reforms due to increased diverse student population [6]. Co-teaching has been an increasingly popular way of teaching in K–12, including special education. Co-teaching has been used synonymously with collaborative teaching, team teaching and inclusion/special education. Co-teaching has been described in a variety of ways in the literature. Cook and Friend [7] defined co-teaching as "two or more professionals delivering substantive instruction to a diverse, or blended, group of students in a single physical space" (p.2). According to Cook, co-teaching is the "shared delivery of instruction" [8]. In special education, the co-teaching, the general education and the special education teachers work together in the same environment in a variety of instructional activities to provide optimal instruction to the greatest number of students.

Co-teaching is designed to promote communication and collaboration among professional educators to improve instruction for all learners. Cook and Friend [7] identified five co-teaching models in a face-to-face classroom environment as shown in Table 1.

Co-Teaching Models	**Teacher Roles**
Lead and Support	One teacher has the primary responsibility for planning and teaching, while the other teacher offers assistance and support to individuals or small groups (e.g., observe particular behaviors or distribute teaching materials).
Station Teaching	Students are divided into heterogeneous groups and work at classroom stations with each teacher. Both teachers divide the instructional content, and each takes responsibility for planning and teaching part of it.
Parallel Teaching	The teacher and student teacher plan jointly but split the classroom in half to teach the same information at the same time.
Alternative Teaching	One teacher manages most of the class while the other teacher works with a small group inside or outside the classroom to pre-teach, re-teach, supplement, or enrich instruction.

Team Teaching	Both teachers are actively involved in the management of the lesson and discipline. Both of them are responsible for planning, and they share the instruction of all students. The lessons are taught by both teachers who actively engage in conversation, not lecture, to encourage discussion by students

Table 1: Types of Co-teaching Models in a Classroom Setting

Moreover, multi-pedagogical models for online teaching were addressed in the literature based on Lewis' study cited in Young [9] on cooperation and collaboration in team teaching. These models with six expansions are described in Table 2 [9, 10].

Co-Teaching Models	**Teacher Roles**
1. Single-teacher-offering Pedagogy Model	A teacher performs several tasks (e.g., designs and develops materials, monitors work progress, selects topics for discussion and responds to questions, grades papers, evaluates assignments and conducts all other activities in a course.) S/he has full control of the course and has to spend a lot of time to exert this control.
2. Group Pedagogy Model	This model can be performed with structured interaction designed to facilitate course achievement of a goal by instructors who work together in groups. A group pedagogy model was divided into three models by Lin et al [10].
a. *Cooperative pedagogy model*	Courses are run by one primary teacher with co-teachers such as teaching assistants, consultants and others.
b. *Collaborative pedagogy model*	Each teaching team has a different role and team members have the same right with no domination of one over the other.
c. *Co-teaching pedagogy model*	Each teacher is in charge of different topics at different times.
3. *Cluster Pedagogy Model*	Different course teachers share a single discussion board, course materials or examination questions. Various teachers can integrate courses in the same domain. This model has two basic divisions:
a. United pedagogy model	Teachers of courses in different domain may share discussion boards, examination questions, announcement and experiences.
b. Central pedagogy model	One teacher or teaching team may teach several courses with different classes.

Table 2: Online Pedagogy Models in Context of Co-teaching

Each of these pedagogy models may have a place in different educational environments. However, the collaborative and co-teaching models may give instructors more equal opportunities to share responsibility for instruction and student learning. If an unequal co-teaching partnership and distribution of power exists, this may lead to frustration and failure [11].

The literature in co-teaching in the healthcare area is not extensive. Orlander et al. [12] have developed a model of "co-teaching" for faculty development that can be applied to any clinical rotation. Physicians are paired to develop their teaching skills while sharing the clinical supervision of residents and medical students in the usual clinical settings (e.g., attending, teaching rounds, clinical precepting and case conferences.) As a result, co-teachers gain experience in analyzing teaching encounters and developing skills in self-evaluation. Crow and Smith [13] report the findings of a collaborative inquiry on their experience as tutors co-teaching inter-professional collaboration to a multidisciplinary group of undergraduates. They have different professional/academic backgrounds, and the student group included health and social work professionals alongside a number of non-professionals.

Both online and face-to-face co-teaching models have many components in common that lend themselves to instructional collaboration, and those models are applicable in many teaching settings. There are numerous self assessment tools available for assessing readiness to co-teach in a face-to-face class [7, 14,

15, 16]. In addition, the challenges and benefits of co-teaching have been well documented in the literature [17].

In our masters program, a few courses used “Lead and Support” and “Parallel Teaching” models. In the Medical Informatics course we used a “Team Teaching” approach to co-teaching, which helped us blend each instructor’s expertise and teaching styles to strengthen the instruction. These approaches equally distributed our responsibilities and actively involved both of us in the teaching process compared to other co-teaching models and pedagogy approaches referred in Table 1 and 2. Since the second instructor was inexperienced teaching online, this enabled the first instructor to provide on-the-job-training, which is based on the principle of learning by doing. This principle can be verified with the model developed by Orlander et al. [12] as well.

C. Course Design and Development

The best course design comes from a diverse, combined joint team effort by challenging and strengthening each other’s ideas, as in the adage, “Two heads are better than one.” One of the instructors is an expert in education and online pedagogy with an educational background in instructional design and technology. The second instructor is an expert in the content of medical informatics. Combining these strengths made the course development process faster and facilitated the “train the trainer” aspects of the course design. Thus, instructional principles and procedures were employed in a rapid mode using a flexible framework. The mixed method of various instructional design models permitted focusing on the learner's characteristics and needs.

In designing an online course, content is important, but creating experiences around the course content is also important and key to effective learning. We needed to answer a series of questions about content, scope, and interactivity of the course as a joint effort. Since the course participants’ technical domain skills (e.g., technology literacy levels) were limited, the course was developed as an introductory course in medical informatics with no prerequisites other than general computer literacy (*Note*: students are surveyed for technology experience in the Integrating Technology Across the Curriculum course). The course content covered the following introductory topics in Medical Informatics

- Introduction to Health informatics (The role of computers in medicine; current health system issues; the need for change; medical data)
- Standards in Health Informatics (Importance of standards in health informatics; development and maintenance of standards; different aspects of standards in health informatics; strengths and weaknesses of major standards used in health care)
- Electronic Health Record (Definition of EHR; history of the patient record; different types of health record; functional components of EHR; data entry methods for EHR)
- Clinical Information systems (Major issues in clinical information systems; clinical information systems and EHR; nursing information systems; patient monitoring systems)
- Decision support systems (Requirements for a decision support system; dimensions of clinical decision support; scientific challenges in building clinical decision support)
- Medical Imaging (Role of imaging in health care; characteristics of digital images; 2D and 3D; modalities; image analysis; integration of imaging information to medical data
- Public Health and Consumer Informatics (Role of informatics in public health; primary care informatics; consumer access to health information)
- Bioinformatics (Sequence, structure and biological pathway information; sources for biomedical data; medical record and biomedical data; computational challenges of bioinformatics in the

future)

- Ethical and Moral Issues in Medical Informatics (Privacy and security in health care; Health Insurance Portability and Accountability Act (HIPAA); ethics of medical informatics practice)

After defining the course content and selecting relevant required text books, articles, and external web resources, we developed our course syllabus along with 10 detailed outlines (learning modules), one for each week. These outlines were a detailed map that contained weekly instructional topics and objectives, including reading assignments, discussion questions and grading criteria/rubrics. All other instructional materials, handouts, and PowerPoint presentations were designed and developed based on the weekly outlines instructional plan. Creating experiences around the course content was a smooth process even though writing discussion questions required dramatic rethinking of medical informatics in the practice setting. All materials were organized in folders labeled Week 1, Week 2, Week 3, etc. This organization permitted the students to navigate easily through the course materials and the instruction. Both instructors collaborated via email and Skype, a Voice over Internet Protocol (VoIP) tool, during the course design and development.

The course was conducted as a distance learning experience utilizing Blackboard and WebEx. All course materials were presented online in both asynchronous and synchronous format. Participants submitted assignments via discussion board, file exchange or digital drop box, depending on the nature of the assignment. The important instructional activities included reading, researching, discussing, completing assignments and participating in the WebEx meeting. The online week for this course was from Wednesday to Tuesday of the following week. Since all participants were full-time working professionals, this gave them more time and flexibility using their weekends for the course. Each week, discussion questions were posted on Blackboard to encourage interactive participation within the class; student participation was required and graded. Expectations for discussion board participation for each week were a direct response to the discussion questions plus a comment on another student's response. Grading of discussion board participation was based on the quality of scholarly information and dialogues using rubrics. The instructors provided weekly feedback/overview to strengthen and reinforce student knowledge. The instructors provided a "Personal Communication" area within the Discussion Board, including "Student Reflections" regarding the course materials and teaching methods.

Each student completed a final project involving research using the Internet and other academic resources based on a detailed project proposal guideline.

D. Cost-Effective Technology Tools

Technology costs can be serious obstacles to utilizing communication tools for online teaching. CCHMC has a site license for an Internet Enabled Conferencing Tool (WebEx) that incorporates Web conferencing, video conferencing, and teleconferencing. We use WebEx meetings to supplement the online discussions periodically, allowing students' final course presentations and masters project defense. Each meeting had some cost based on the number of students. However, other powerful technologies for synchronous communication that are available at no cost can still facilitate the teaching and learning process. For the synchronous part of the course, we communicated primarily through Skype, which can be downloaded on most computer operating systems, but does require the purchase of a microphone if one is not built into the user's system. Skype also permitted us to provide virtual office hours. Although our course platform, Blackboard, permits a visual display of material and the use of a virtual classroom with a whiteboard, Skype provides more interactive communication for synchronous meetings both for extending interrelationships of the two instructors and for students on discussion with the instructors for their group projects. We used WebEx for this course only for the participants' final project presentations

because it permits sharing presentation documents, online searches, asking questions, interacting with other participants, printing or saving instructional materials, chatting, recording, remote control of other computers, and file transfer, all from participants' desks, some of which Skype does not offer.

III. EFFECTIVE STRATEGIES FOR CO-TEACHING

Keefe et al. [17] attribute successful co-teaching to: a) knowing yourself; b) knowing your partner; c) knowing your students; and d) knowing your "stuff." Following this advice to promote co-teaching in an online environment, these strategies were applied by the two instructors in the Medical Informatics course:

- We established some ground rules at the beginning of our collaboration [18]. These rules, which were negotiated between the two instructors, were needed for course development and effective instruction:
    - Course development will be completed and ready to go for the spring of 2005.
    - Instructor compensation will be paid at the end of the course.
    - Problems with developing and teaching the course will be solved by mutual agreement.
    - Mutual respect for each other's contributions and professional ethics will be preserved.
    - Prompt response to emails (within 24 hours) and attendance at online meetings will be expected during the course development and teaching.
    - The collaboration will be long term rather than one time teaching, and course products will be shared between instructors.
    - Both parties will communicate clear expectations and consequences for behavior.
- We identified our responsibilities and common goals, and worked towards them [19]. During the course development process, the materials were exchanged back and forth for revision and editing. During the course, the first instructor (KOL) assumed responsibility for course mechanics (deploying all the materials online, posting questions weekly and sending general emails to the students), and the second instructor (MS) provided feedback to the students' postings (as content expert). He also provided the majority of supervision to the students regarding the final project.
- We displayed open, positive, honest, and frequent communication to discuss the progress of the course. Due to her experience teaching online in the master's program, the first instructor provided constant feedback regarding online teaching to the second instructor.
- We made a commitment to make the course successful building our relationship on collegiality, parity, communication, respect, and trust.
- We established consistent expectations from the learners, and both of us reflected those expectations in our teaching methods. These expectations were posted on the program course web site.
- We developed the syllabus and other instructional materials paying attention to quality, organization, and inclusion of all critical information. This was reflected in the student satisfaction and learning outcomes based on the course evaluation data.
- We encouraged a weekly journal log to be aware of the students' needs and expectations. Students who posted their reflections received extra credit, which was considered in the final grading.
- Technology support and access are necessary to online instruction. We provided timely expert technology help as needed and always had alternative technologies available in the event of technology failure (for example, WebEx as a backup to Skype).
- We were comfortable with each other's strengths and weaknesses to bring certain characteristics,

knowledge and skills to the co-teaching situation. Because the first author of this paper is experienced in teaching both face-to-face and online environment, she was able to assist and train her co-instructor regarding online pedagogy, including course development. Her co-instructor also had high motivation to learn. Collaborative and co-teaching pedagogy models (see Table 2) were applied most of the time since these models eliminate power and domination issues for each instructor.

There were also some challenges to co-teaching across continents largely due to scheduling and educational system differences:

It was difficult to arrange the final synchronous meetings with students (WebEx) because of the seven hour time difference. This challenge was met by the second instructor volunteering to attend the synchronous meetings during non-business hours.

Cultural differences between the instructors and students led to some difficulties early in the course. The second instructor was overly cautious providing feedback to students due to concern for respect and personal sensitivity, which are rooted in culturally-based norms and practices. We were able to resolve this issue in the third week by means of a constructive discussion with the class in which these issues were acknowledged and discussed openly.

IV. STUDENT PERFORMANCE AND SATISFACTION WITH THE COURSE

For the first offering of this elective course 13 students enrolled (Our cap is 20 students per class.); six females, seven males, age range 29 to 60. There were multiple disciplines and a wide geographic distribution among the students (Table 3). Course retention was 100% and grades were satisfactory (eight As, one B+, three Bs, and one "Incomplete" due to failure to meet the final project deadline).

Discipline	States/Country
Emergency Medicine (3) Rheumatology (1) Internal Medicine (2) Education and Nursing (3) General Pediatrics (1) Family Medicine (2) Pediatric Pulmonary (1)	California (1) Ecuador (1) Ohio (8) Texas (1) Massachusetts (1) Illinois (1)

Table 3: Student Demographics

We used a descriptive approach to examine course satisfaction of the students. This approach included both review of student participation and student reflections on the course.

E. Student Participation

The course was structured using weekly activities (one individual task and one group task) which resulted in very high interactivity within the class. Activities included the mandatory postings and feedback to classmates. The number of postings varied from week to week depending on the nature of the discussion questions, but there was an average of 60 postings for individual tasks each week and around 45 group postings (These postings included feedback comments, but they do not include the Student Reflections and Personal Communication postings.)

Apart from the instructors' questions, students posed questions to the instructors and classmates. The

number of these varied from week to week, from 10 to 15 questions. The Final Projects and Personal Communication Forums were also used for asking questions to the students and instructors.

Most of the assignments were application level, and students were very engaged in the learning process as evidenced by 100% completion of the weekly assignments.

Final projects and presentations demonstrated high quality work and were completed by the due date by all but one.

The responses in #1 and #2 above, completed assignments (#3), and final projects (#4) suggested that the course objectives were met successfully as defined in the syllabus and the weekly outlines. A grading rubric was used to evaluate performance in all of these areas.

F. Student Reflections

We asked the students each week to make comments on the current week's topics and learning activities in a designated forum on the discussion board (an optional forum for extra credit). The following are some of their remarks excerpted from their reflections, which illustrate students' satisfaction with the Medical Informatics course:

"This week's reading was incredibly fascinating. Having used decision support systems, I could really relate to this topic. The information from this week's reading gives me hope in what may be available in the future in terms of improving patient safety, care and decision making."

"I liked that this course discussed a new and different topic of the medical field. It was very informative and eye opening. I learned a significant amount of information that will help broaden my scope in the design of curriculum and instruction."

"I enjoyed collaborating online with another student on my final project. … I found the topic on electronic health records most enlightening. This was extremely helpful to me as we are currently choosing electronic health records for our health system."

"Excellent course — keep up with the hi tech!"

"Make this a mandatory part of the curriculum"

***"**This course has been interesting and it is amazing that this is the first time it has been taught. As someone who is no longer in the clinical environment, it is not as applicable to my daily work which is a bit disappointing. However, it has made me more aware of how information is stored and accessed which is important for me in teaching individuals who are forced to deal with such systems. It has also given me ideas for ways to store research data in a new way."*

"As the class progresses I continue to see how more and more relevant this information and its application is on a daily basis. The information I am learning here will certainly be useful in the group I am joining. Currently the group is looking into integrating their EMR with the one the hospital will obtain (still up in the air). The group has been piloting VOIP, smartphones, PDAs, and tablet PCs. I look forward to using my new knowledge and online experiences in adding to their advancement."

"Just a constructive thought. I've found it difficult at times to navigate through our required reading. I appreciate online resources and xeroxes of select chapters from texts, but I miss having complete *books. The Medical Informatics Handbook is difficult to understand online, because the figures are in a different section from the tables, and in a different section from the text. I see that the handbook is available for about $65 on Amazon and wonder whether it would be worth it for me to just go ahead and buy it. …..… The PowerPoints have been very helpful in providing an overview of the weeks material, thank you. If I had to suggest something for the next time the class is offered, I'd suggest getting the real texts. Thanks; so far the class has been very good."*

V. COURSE EVALUATION

All students had taken at least three or more other online courses in the Online Masters program and had used the Blackboard course platform. They were also familiar with our course evaluation forms distributed at the completion of the course that focus on the presentation of the content, the pedagogical aspects of the course, teaching competency of the instructors, instructional and communication methods, and quality of the students' learning experiences. The following comments are derived from these formal course evaluations.

A. PowerPoint Presentations, Handouts and Challenge Activity

The PowerPoint presentations and other instructional materials for the course were developed based on the course goals and objectives. Since the course goals and objectives were defined in detail both in the course syllabus and the weekly outlines, students were able to match those goals and objectives with the actual course materials. In addition, weekly outlines provided a framework for students to organize their plans for successfully completing the course. These weekly outlines defined topics, objectives, major skills, knowledge, or abilities needed to perform course activities/tasks effectively, including the grading criteria. Comments from the students:

"I really like the PowerPoint presentations to help guide the reading. I too have been gratified to see the dialogue between students develop…."

"PowerPoint presentations are always helpful and effective"

"The PowerPoint summaries were most helpful to me in gaining an overview of the subject before reading the text."

"The handouts were very helpful"

Although most students indicated their positive experience with the reading materials, one student expressed feelings regarding the navigational difficulty in the online text book:

"The online textbook by van Bemmel was difficult for me as I work much easier in a linear fashion. However, I feel that including online texts like this is essential in increasing the learning curve of students or not used to using Hypertext books. So, although it is hard I think it should continue to be included."

The most positive feedback on the online instructional activities were those meant to foster student critical and creative thinking. Besides flexibility, online co-teaching supported our instructional creativity. One of the activities we developed is called "Challenge". This was expected weekly either in a group format or on an individual basis. In this activity, students or groups challenge each other with a question

that they devised from their readings or from a search on the topic covered during the current week. Here is one example:

I hope you are well. I interacted with you last year during one of the classes. You seem to be the furthest ahead in the work this week, so how about if I pose a question so you can finish up?

My father is an adolescent medicine (pediatrics trained) physician at a college back home in Texas. Ever since I started using computers in medical school (mostly my last year) for evidence based searches and to help with patient care, he has been skeptical. He worries that somehow computers and "guidelines" will compromise the "art of medicine." Now granted, some of this may be "fear of the unknown" (It was a major feat teaching him to check email!), but, briefly, how would you begin to convince him otherwise? (Lord knows I've tried!) This week's readings touched here and there on the "art of medicine;" it made me think of this."

There were rules for the "Challenge" activity. A student or a group may only be challenged once. Students were not allowed to challenge the person/group who challenged them. If one person or group is challenged more than once (e.g. two postings at the same time by different students), the first challenge was applied and other had to be changed to a different group/student. The following comments illustrate students' feelings about this activity:

"…The challenge questions are something new... and just that-- a challenge! You really have to grasp some of the information in order to formulate a meaningful question. I'm still getting a grasp on the concept of informatics. A good question for discussion for the first week is to have the students look up definitions of informatics and then discuss in a thread…."

"At first I was a bit skeptical of how the challenge weeks would work. Having completed a couple of them now, I have to admit, that I really like them. It forces me to look at the week's readings in a whole different light. I think I look at them more critically. It makes me more of an active reader, than a passive reader. Thanks for the challenge!"

B. Feedback

Prompt and consistent feedback is essential in an online teaching environment, whether it consists of threaded discussion responses, email comments on papers and assignments, formal comments on student and group papers and projects, or real time conferencing. Feedback can be both individual and general to the group. In this respect, feedback is a critical teaching tool, especially when teaching medical professionals who are accustomed to giving and receiving feedback in their work. Both instructors provided consistent, prompt feedback in a timely fashion on students' discussion board messages and other assignments. The following are the comments from students on feedback:

".....I often look forward to the instructors' comments to help solidify the discussion and round out the answer to the discussion questions"

"…I do find that the instructors' comments at the end of discussions are extremely helpful in bringing the entire discussion together…"

"Consistent feedback comments on the discussion board and emails"

"In terms of feedback for the course, I liked how the instructors saved comments for later in the class discussion in the last weeks. For me this helps the students develop a dialogue. In one previous class, the

instructor was often first to post comments often terse in nature. I felt this inhibited my natural reaction to posting comments. …."

In an online learning environment, it is important to provide answers students' questions in an efficient and timely manner. This strategy helps maintain students' motivation and keeps them engaged in the learning process. Both instructors made every effort to answers students' questions in maximum 24 hours time frame. One of the benefits of co-teaching was sharing this responsibility so that students could receive much quicker responses from us. Responses also enhanced the quality of our teaching as well as our collaboration. In the course evaluation, many of the students indicated that they appreciated the prompt responses to their postings.

C. Final Project

Students were required to do a final project with the option of an individual project or a group project. For those who preferred to do a group project, the project scope was assessed based on the number of students involved so that each participant had a portion for which s/he was responsible. The project proposal guideline was provided both for individual and group projects. A few students liked the group project idea and said:

"Term project in pairs was an excellent format!"

There were no negative comments about the instructors. Even though both instructors speak English as a second language, none of the students reported language or communication as negatively affecting their learning experience.

VI. LESSONS LEARNED

This experience in international co-teaching provided us with a model for future collaborations as our program evolves and matures. The most challenging aspect of the experience was the additional time and effort needed to plan the course due to the need to exchange materials and ideas back and forth electronically (and asynchronously). This slowed the usual give and take process typical of a collaboration, especially in the early stages of development. At the same time, several benefits, some expected, some not, emerged from the collaboration:

1. The collaboration encouraged mutual learning from each other allowing a bilateral train-the-trainer concept. The first instructor increased her content knowledge of medical informatics and her efficiency as a medical educator. The second instructor learned how to transmit his extensive content knowledge to the online environment using sound principles of distance teaching pedagogy. This included the increased time requirement of online instruction due largely to the asynchronous nature of the teacher-student interface.

2. Sharing the responsibility of student feedback between the two instructors was beneficial to the instructors and students by the added timeliness and efficiency. This also encouraged effective co-teaching compatibility, which is a significant component of successful co-teaching relationship. The second instructor was able to appreciate that prompt and timely feedback increased the student engagement in the learning process while it helped them build a strong learning community.

3. A model of online co-teaching emerged by experimenting with communication technologies. The advantages of technology-powered education made it possible to convert the traditional models of

teamwork into creative teaching strategies on a global scale. This provided the second instructor with valuable professional development and the opportunity to increase his confidence as an educator.

4. Teaching online is a labor-intensive process for the instructor due to course preparation time, time spent teaching, asynchronous interaction with students, and office hours. The division of labor between two instructors encouraged uninterrupted instruction and eliminated potential bottlenecks in the discussion board postings.

VII. DISCUSSION AND CONCLUSION

Modern medicine employs information technology to bridge the gap between what is known and what the doctor needs to know at the point of delivery of care. This course in medical informatics is an important option for future medical educators, and we are pleased to offer these coordinated and integrated educational opportunities. The web environment offers significant benefits in collaboration and enables co-teaching in an online, Web-based environment with advantages over the traditional classroom setting. The web format also offers an environment that is as effective as face-to-face teaching for "teach the teacher" activities that can be mutually beneficial to both co-teachers. Chrislip [20] states that collaboration is stronger than cooperation and partnership because it requires the consideration of shared power and may be defined as a "shared responsibility for achieving results" (p. 304).

In this distance learning course on medical informatics, both instructors found collaboration rewarding and were pleased with the outcome of this venture. First, this course resulted in a high-quality, first experience in teaching medical informatics online. Second, pedagogical transformation for the second instructor was smooth. Third, the first instructor was able to increase her content knowledge in the topic. The second instructor has now joined the core instructors group in this online masters program and will be teaching this course every year. In fact, the course was offered again in the Summer Quarter of 2006 with some minor modifications, and the second instructor taught it by himself. Course evaluation scores were very similar to the previous year. One of the student comments was very interesting:

Murat was very responsive to email questions. It was very interesting having an instructor outside of the US. I was a little overwhelmed at first with thinking of informatics globally but then I realized that we could put our own perspective into the assignments. I think this is a great course and Murat has much knowledge to share with all the students.

Although co-teaching requires thoughtful planning and additional time and effort to initiate, we believe that co-teaching online has tremendous potential and is a viable option for online educators who are separated by distance and, perhaps, time. Furthermore, pairing an experienced distance learning instructor with a distance learning novice can be a cost effective model for training new instructors in online teaching. It offers an opportunity for professional development for both the experienced and new online teachers, promotes diversity, and fosters professional collaboration. Online co-teaching also encourages instructional change and improves the quality of designing and teaching courses. Further research should be conducted to identify specific benefits and challenges of co-teaching and to evaluate the effectiveness of it in the training of new online instructors.

VIII. REFERENCES

1. **Jonassen, D. H.** Thinking technology. *Educational Technology* 34(4): 34–37, 1994.

2. **Austin, A. E. & R. G. Baldwin.** *Faculty collaboration: enhancing the quality of scholarship and teaching.* ASHE-ERIC Higher Education Report No. 7.Washington, DC: The George Washington University, 1991.
3. **Montiel-Overall, P.** Toward a theory of collaboration for teachers and librarians. *School Library Media Research*, 8*:* 2005.
4. **Lewis, K. O. & R. C. Baker.** Development and Implementation of an Online Masters Degree in Education for Healthcare Professionals Program. *Academic Medicine* 80(2): 141–6, 2005.
5. **Hersh, W. R.** Medical informatics: Improving health care through information. *JAMA* 288(16): 1955–1958, Oct 23 2002.
6. **Friend, M., M. Reising & L. Cook.** Co-teaching: An overview of the past, a glimpse at the present, and considerations for the future. *Preventing School Failure* 37(4): 6–10, 1993.
7. **Cook, L. & M. Friend.** Co-teaching: Guidelines for creating effective practices. *Teaching Exceptional Children* 28: 1–16, 1995.
8. **Spencer, S.** An interview with Lynn Cook and June Downing: The Practicalities of Collaboration in Special Education Service Delivery. *Intervention in School and Clinic* 40(5): 296–300, 2005.
9. **Young, S. S.-C.** In search of online pedagogical models through investigating a changing teaching paradigm in the School for all community. *Journal of Computer Assisted Learning* 20(2): 133–150, 2004.
10. **Lin, C.-B., S. S.-C.Young, T.-W. Chan & Y.-H. Chen.** Teacher-oriented adaptive Web-based environment for supporting practical teaching models: a case study of ‘‘school for all’’ *Computers & Education* 44(2): 155–172, 2005.
11. **Murawski, W. W. & L. A. Dieker.** Tips and strategies for co-teaching at the secondary level. *Teaching Exceptional Children* 36(5): 52–58, 2004.
12. **Orlander, J. D., M. Gupta, B. G. Fincke, M. E. Manning & W. Hershman.** Co-teaching: A Faculty Development Strategy. *Medical Education* 34(4): 257–265, 2000.
13. **Crow, J. & L. Smith.** Using co-teaching as a means of facilitating interprofessional collaboration in health and social care. *J Interprof Care* 17(1): 45–55, 2003.
14. **Adams, L. & K. Cessna.** Designing systems to facilitate collaboration: Collective wisdom from Colorado. *Preventing School Failure* 35(4): 37–42, 1991.
15. **Bradley, D. F., M. E. King-Sears & D. M. Tessier-Switlick.** *Teaching students in inclusive settings: From theory to practice.* Boston: Allyn & Bacon, 1997.
16. **Murawski, W. W. & H. L. Swanson.** A meta-analysis of coteaching research: Where are the data? *Remedial and Special Education* 22(5): 258–267, 2001.
17. **Keefe, E. B., V. Moore & F. Duff.** The four “knows” of collaborative teaching. *Teaching Exceptional Children* 36(5): 36–41, 2004.
18. **Stevenson, C. B., R. L. Duran, R. A. Barrett & G. C. Calarulli.** Fostering faculty collaboration in learning communities. *Innovative Higher Education* 30(1): 23–37, 2005.
19. **Dieker, L.** *The Co-teaching Lesson Plan Book.* Whitefish Bay, WI: Knowledge by Design, Inc., 2002.
20. **Chrislip, D.** *Collaborative Leadership Fieldbook: A Guide for Citizens and Civic Leaders*. San Francisco, CA: Jossey-Bass, 2002.

IX. ABOUT THE AUTHORS

Kadriye O. Lewis, Ed.D is Field Service Assistant Professor of Pediatrics at Cincinnati Children's Hospital Medical Center. She coordinates and supervises the educational activities within Division of General Pediatrics of the Cincinnati Children’s Hospital Medical Center, including program development, curriculum and evaluation. She is the education consultant to the medical center’s faculty development program, an integrated, multi-level, multidisciplinary program of faculty development in teaching. Most recently, in collaboration with the College of Education at the University of Cincinnati, she and her colleague, Dr. Raymond C. Baker have developed an online Master's Degree in Education for Physicians

and Other Healthcare Professionals, which has been offered both nationally and internationally since 2002 (www.cincinnatichildrens.org/masters). She is the associate director of the program and also teaches two courses online.

Murat Sincan, MD is currently working in the Department of Medical Education and Informatics at Hacettepe University Faculty of Medicine as an academic expert. He received his Doctor of Medicine degree from Hacettepe University Faculty of Medicine in 1999. He is currently pursuing his PhD in Information Sciences at the Informatics Institute of Middle East Technical University. Dr. Sincan was a Research Fellow at the Children's Hospital Boston in 2004 under the Fogarty International Program of NIH. He teaches undergraduate and graduate level courses at Hacettepe University Faculty of Medicine and Institute of Health Sciences. Dr. Sincan is an active member of American Medical Informatics Association and a former General Secretary of the Turkish Medical Informatics Association. He is currently involved in "The HacetTELE Telemedicine Project" funded by Devlet Planlama Teskilati (the State Planning Organization). He also received funding from "International Mental Health and Developmental Disabilities (MHDD) Research Training Program" Fogarty/NIH and "SBIR Phase I Medical Research Training Program Web Collaboratory" NIMH/NIH.

ONLINE EDUCATION TODAY

A. Frank Mayadas
John Bourne
Paul Bacsich

Online education is established, growing, and here to stay. It is creating new opportunities for students and also for faculty, regulators of education, and the educational institutions themselves. Much of what is being learned by the practitioners will flow into the large numbers of blended courses that will be developed and delivered on most campuses. Some of what is being learned will certainly improve pedagogical approaches and possibly affect other important problems, such as the lengthening time to completion of a degree. Online education is already providing better access to education for many, and many more will benefit from this increased access in the coming years.

In a 1995 *Science* article, Eli Noam of Columbia University opined that the Internet would pave a difficult road ahead for traditional academic institutions; he wrote, "as one connects in new ways [the Internet], one also disconnects the old ways" [1]. Thirteen years after Noam's article and 15 or so years after Internet usage began its rapid acceleration, online learning has become an important element in education, although it is not evenly distributed across institutions.

The term "online learning," however, obscures vast differences in methods supported by this educational approach. We limit this discussion to online education in traditional, regionally accredited, degree-granting institutions. Within this discussion, we include "blended courses," that is, those that feature some online elements but less face-to-face time than encountered in an equivalent traditional course. We do not discuss online education in the rapidly developing kindergarten through grade 12 environment, online corporate training, or the free educational resources (complete courses in many cases) being made available online by some universities, such as the Massachusetts Institute of Technology (MIT), Yale, Stanford, and a few others [2]. These are widely accessed throughout the world but do not provide credit as courses or as partial fulfillment toward degree completion. These efforts can thus be thought of as use of the Internet to disseminate, free of charge, valuable, high-quality information, but not credentials, whereas the focus of this paper is on use of the Internet to provide access to educational credentials through use of the common tuition and fee mechanisms.

Generally, in corporate training, online learning means accessing short training modules that cover specific topics (e.g., quality practices, new product information, and diversity practices) available as self-study units on the corporate intranet. In this sense, the online aspect is providing an efficient distribution mechanism, replacing CDROMs or even printed manuals. In contrast, institutions of higher education offer their courses in quite a different form: In most cases, class cohorts are formed rather like traditional classes that start and end on specific days. These online classes are led by faculty members who most likely require participation from students on topics that are being covered, and discussions and exchanges of ideas among cohort members. A participant may seek help on a problem set or clarification of an assignment from classmates who are distant but online. This capability of student-to-student and student-to-faculty interaction, coupled with instant access to information resources worldwide on the Internet, plus the efficient distribution of class materials (readings, homework assignments, and possibly stored video lectures) distinguishes modern online education from older "distance education" models built around correspondence or television.

From [A. Mayadas et al., Online Education Today. *Science* 323: 85–89, 2 January 2009]. Reprinted with permission from AAAS.

In this modern version, basic technology requirements for students anywhere in the world are conventional personal computers with a broadband connection to the Internet. Students and faculty engage in classes using course management software [3], and classes are conducted "asynchronously," that is, there is no need for students and faculty to assemble at the same time, as in traditional classroom instruction. Indeed, course management systems have become ubiquitous in higher education, used for both online and on-ground asynchronous instruction. Synchronous software is sometimes employed for simultaneous voice and text discussions, often as an optional class activity. Newer devices like iPods are being employed in a number of instances, and even virtual environments such as Second Life [4] are quite widely seen in connection with corporate or specialized lecture-style environments. For institutions that offer for-credit courses and degrees, however, newer methods of teaching are mainly at an early, experimental stage.

The annual Sloan Consortium survey of online education [5] provides an information base for positioning the online modality as an important element of education. The study reports the responses of chief academic officers at 2500 degree-granting institutions of higher education to the online teaching and learning landscape (the response represents more than 50% of all such institutions in the United States). The most recent survey, published in 2008, reports that 3.94 million students enrolled in at least one online course for the fall semester of 2007 in a wide range of disciplines (see Fig. 1). Annual enrollment increases have averaged just below 20% over the past 6 years of this study, leading to the result that today more than 20 to 25% of all students in U.S. colleges enroll in at least one online class. Many of these students are off-campus learners with a wide range of ages, work experience, and family circumstances; however, at a number of institutions, about half of the online enrollments are estimated to be full-time "traditional" students attracted to online courses for reasons of convenience or scheduling. Most are at public institutions—state universities, colleges, and community colleges—all of which offer at least some online education. Some of these institutions report large enrollments, for example, in the tens of thousands; community college enrollments alone account for about 50% of the 3.94 million students enrolled.

In contrast, only about half of the traditional private institutions provide any sort of for-credit online course offerings. Among those that do, however, are institutions such as Stanford and Johns Hopkins, both of which offer courses and some degree programs entirely online. Harvard and the University of California, Berkeley, also offer courses online, but mainly through their extension units; they offer no degree programs. Other elite schools, such as Princeton, Yale, and MIT, offer no online courses for credit or degree programs. In comparison, the enrollment at Pennsylvania State University's World Campus exceeds 20,000. The enrollment at the University of Massachusetts online unit (UMass Online) exceeds 35,000. Rio Salado Community College in Phoenix reports similar numbers. The University of Illinois, Springfield, a small institution, now has an online student population approximately equivalent to their on-campus enrollment. Overall, the highest growth rates are at community colleges and at for-profit organizations such as University of Phoenix, Kaplan, and Capella. It appears that, to this point, online education has not resulted in Noam's "dim circumstances" for the many institutions that have adopted online education. In fact, the fear that fewer faculty would be needed has been turned on its head: More faculty are being hired to service burgeoning online enrollments. Neither has online growth created a dim prognosis for highly endowed institutions, many of which have no online education program. It has, however, drawn the attention of other stakeholders, such as governments (both state and federal) and accreditors, now being forced to deal with an educational activity very different from traditional classroom teaching.

IMPACT ON STUDENTS

A primary driver for online education is the presupposition of faculty and university administrators that a sizable population of potential learners exists—typically, working adults who wish to obtain college credit and credentials but who cannot do so because of time restraints imposed by work, family, community responsibilities, or lack of proximity to a suitable educational institution. Faculty members and institutions expected the asynchronicity and distance-independence of online education to be an answer for this population. Largely, this assumption has proven to be true. We have no accurate national profile, however, of the age of the "average" online students and their demographics, nor are those facts likely to emerge in the near future; no national profile of "traditional students" exists either, but some inferences are possible from individual institutions that collect data about online students.

The University of Central Florida, a large metropolitan university in Orlando, has developed an excellent, regularly updated database of its online students. Their analysis [6] contains some surprises: Of 115,000 students enrolled in their blended online courses in the seven-semester period from summer 2004 to summer 2006, nearly 80% represented the so-called "millennial" generation (born after 1980); they dominated enrollments in lower- and upper-level undergraduate classes, and also in graduate classes. The remaining 20% comprised earlier generations, including a small number from the "matures," born before 1946.

Are the several million students who have taken online courses satisfied with their learning experience, and have they had a high-quality learning experience? Is online learning a doorway to high quality education? These questions are difficult to answer because huge variances exist in instructors' teaching skills and experience, course organization, and in study materials for students. These elements provide variations similar to the differences in educational outcomes found in traditional classrooms. From data provided by individual institutions, we do see quite uniformly that grades and completion rates for well-designed online courses taught by experienced instructors tend to result in equivalent outcomes for both online and traditional students [7–9]. In most cases, therefore, it appears that online students receive an education equivalent in quality to what they would receive in traditional classes, and their drop-out rates appear to be about the same.

IMPACT ON FACULTY

The emergence of online education has had an impact on faculty as well, certainly on those who teach classes online, but also on those who are experimenting with Web-based elements blended into traditional classes. Eventually, we expect Internet use in courses to envelop all faculty, as blended approaches become the norm for college courses over the coming 5 to 10 years. In the United States, about 1.3 million faculty work in degree-granting postsecondary institutions; of those, about half are full time [10]. The 3.94 million students taught online represent about 22% of the estimated total national student population. If the number of faculty is roughly proportional to the students enrolled, then approximately 300,000 faculty engage in online teaching in the United States today. Of those, some estimates place more than 100,000 in the adjunct category [11]; that is, faculty who are not permanent employees of an institution. A commonly held misconception is that online faculty are all or mostly adjuncts. It would likely be fair to estimate that adjunct and permanent faculty of diverse types mirror the full-time/part-time proportions found in face-to-face teaching.

A number of institutions [12–14] conduct surveys of faculty satisfaction factors and attitudes toward online education. Across institutions, the results tend to be quite similar. Almost unanimously, online instructors assert that although preparing and teaching online courses is more time-intensive than

classroom teaching, they plan to continue teaching in that modality for a variety of reasons: the flexibility of "anyplace, anytime teaching" for themselves and for their students, opportunity for professional growth, the option of teaching from home, and interactivity with students, which they report is of higher quality than classroom discussion. These faculty are also motivated by a strong conviction that the work they are doing is important to students who need flexible access to education, although they point out that online students need to be more self disciplined. In addition to the data reported by a handful of institutions, a completed national survey of nearly 10,000 faculty members from a recent diverse sampling of 60 campuses by Seaman and Allen [15] confirms these conclusions. Economic issues also come into play for some faculty. Commonly, an on-ground itinerant faculty member who travels to three campuses a week may absorb sizeable transportation time and costs. Online instruction brightens this picture. By teaching online, those faculty can accommodate an additional course or two—a substantial bonus for an adjunct professor earning a living by teaching.

Because the professoriate is aging, not all faculty members wish to acquire the skills needed to engage with millennial students who befuddle them with wikis, blogs, Web casts, virtual worlds, and course management systems. To ease their transition to this new teaching agenda, many institutions provide support for instructors to transfer their courses to the online modality. Faculty members who subscribe to the mantra "I can't teach them if I can't look them in the eye" will slowly become obsolete except in some exclusive colleges. The millennials are changing the way teaching and learning must be approached. Mobile learning with podcasts, text messaging, and Virtual worlds will be the future norm, giving faculty new tools through which to extend and enhance the educational experience.

GOVERNMENTS, REGULATION, AND ACCREDITORS

Federal and state governments involve themselves in higher education for different reasons. The federal government is involved through its role in federal grant and loan programs such as Pell grants and the Federal Family Education Loan Program; state governments view their role to be licensing and accrediting institutions of higher education within their state boundaries, providing financial support for public institutions in their state, and, in an increasing number of cases, offering their own student aid programs. The states have traditionally asserted a right to impose rules and regulations on institutions that are located on their soil; that is, those with a "physical presence" within their state boundaries.

The role of the federal government in postsecondary education has largely been defined by the Higher Education Act of 1965 (HEA). Responsibility for administration of this law has fallen to the U.S. Department of Education, which delegates key functions and policies to other stakeholders, such as accreditation agencies and the colleges and universities themselves. The recent reauthorization of the HEA, the Higher Education Opportunity Act of 2008 [16], contains several specific provisions that indicate that the federal government is increasingly taking into account the importance of online education as an element in U.S. higher education.

Before 1996, the Department of Education treated asynchronous online learning as conventional correspondence study, and this resulted in a reduction of the federal financial aid available to individual online learners by more than half. In that year, the HEA was amended to separate "courses offered through telecommunications" from correspondence and to treat students enrolled in such courses as equivalent to those attending classes in person. However, reflecting a continuing unease with online learning, Congress limited the applicability of this provision to institutions that still offered a majority their courses in a conventional (that is, face to face) mode. Congress subsequently enacted, and the Department of Education implemented, the Distance Education Demonstration Project that allowed a limited number of colleges to offer more than 50% of their courses online, which opened the door to a

few entirely online institutions. The 50% rule was rescinded in 2006, but the latest amendment to the HEA makes it clear that there is still residual discomfort with asynchronous learning. Although there is no longer any restriction on the ability of a university to offer its programs entirely online, it may only do so if it has secured specific approval from its accrediting commission [17], provided that the accrediting commission has itself been determined by the Department of Education to be qualified to evaluate an institution's distance learning offerings. One provision of the new law bears specifically on asynchronous learning. Institutions offering online programs must establish "processes through which the institution establishes that the student who registers in a distance education or correspondence education course or program is the same student who participates in and completes the program and receives the academic credit" [18]. Congress has assigned responsibility for enforcing this requirement not to the Department of Education but to the accrediting commissions. Other issues in the law directly affecting online delivery of courses are covered in an excellent report from Dow Lohnes PLLC [19].

Although both Congress and the Department of Education have shown increasing interest in online learning, it is the individual states that have been most involved in the regulation of online education. In a recent survey [19], an increasing number of states are asserting what some would consider novel interpretations of "physical presence." For instance, it is common practice for online course providers to require a remote student to take a final examination under the supervision of a proctor, for example, a librarian or a local government official, or to meet with a discussion group of fellow students. Although both of these approaches are desirable adjuncts to effective online learning programs, some states are now asserting that these activities constitute a "physical presence" sufficient to require the institution to be licensed by the state in which the students reside. Indeed, some states have gone well beyond this, asserting that the mere fact of delivering the online program across its borders and enrolling its citizens is sufficient to require an institution to submit to its regulation. These examples show that both federal and state governments and accreditors are clearly being affected by the emerging world of online and blended instruction and that they are experimenting with ways to deal with this new world, particularly in balancing the need to protect consumers against unscrupulous purveyors of substandard programs and yet not interfere with the growth of this essential component of postsecondary education. The complexity of these issues is multiplied many times over when one considers the implications of online learning crossing international boundaries. Governments and quasi public bodies charged with oversight of postsecondary education will need to develop considerably more sophistication as colleges and universities, both within the United States and globally, expand the scope and reach of their online programs.

INSTITUTIONS

Finally, we turn to the question, Are traditional institutions of education facing a threat from the growth and increasing validation of online instruction? There is little evidence today to suggest much of a threat. For-profit institutions such as Phoenix, Kaplan, Capella, and Jones are successful, and their growth rates exceed those of the online programs in traditional institutions. They are clearly meeting a need. However, overall, online enrollments are still dominated by traditional institutions, and certainly all the public institutions and a number of private ones have acquired the skills, infrastructure, and faculty acceptance to allow them to compete effectively and to continue competing. Some evidence indicates that online enrollments in many of these institutions appear to be leveling off, and that is most likely an indication of internal decisions to maintain some arrived-at "balance" between classroom instruction and blended instruction and some overall ceiling on enrollments. Traditional institutions, especially public ones, do have some substantial advantages over for-profit institutions like the University of Phoenix, although it is clear that the distinction is blurring as the most successful for-profit institutions increase their focus on academic performance and as "traditional" schools learn how to compete more effectively in the marketplace, particularly in the context of leveraging name recognition at a local and regional level and,

in some cases, at a national and international level, as well as the ability of public institutions in particular to offer considerably lower prices.

The institutions that have adopted online offerings on a large scale appear to be well positioned to avoid the “dim” future foreseen by Noam. They are adapting and can easily continue to adapt and prosper.

The leadership elements—presidents or chancellors—of the public institutions with large online enrollments are recognizing the strategic advantages of online and blended education and hence are treating this form of education as a strategic priority. Our discussion with the presidents or chancellors of Pennsylvania State University, University of Massachusetts, University of Central Florida, University of Southern Maine, University of Illinois, Springfield, and Rio Salado Community College indicate clearly that they are including online instruction as a strategic asset that is integral to the planning activities of their institutions. So, for instance, online possibilities can affect strategic decisions directed at addressing problems such as insufficient classroom space or reaching new markets (possibly including international students) to provide greater access to education. Some institutions are seeing strategic possibilities in online education to retard, and maybe reverse, the trend toward ever-lengthening time for a student to acquire a degree. Others are seeing possibilities for course-sharing and faculty sharing among geographically separated institutions and for strengthening relationships among community colleges and baccalaureate and graduate institutions.

A number of select, highly endowed elite institutions do not see offering credit-bearing online courses and degree programs as a high priority, although they might make available free course materials, even the content of complete courses, as noted earlier. For these institutions, online teaching and credit-bearing offerings are not a necessary strategic or competitive tool. They do not appear to believe that their futures have been dimmed at all by the appearance of online education on a large scale at other institutions. These institutions, however, along with all others, will adopt and be affected by the more recent growth of blended education.

What of the less highly endowed institutions that have chosen not to involve themselves in online education? For these institutions, it appears the future may be more turbulent, perhaps even dim. Their income is largely dependent on students, and that supply of students may follow a downward path as online options proliferate from other, often distant, institutions. Finally, a quick look at the situation outside the United States indicates that the story is less promising, even in Canada. In Europe, there have been a number of high-profile failures of online universities and a larger number of initiatives that never reached their full potential. (There have been failures in the United States, too, but few compared with the successes.) These include the UK e-University [20], the Scottish Interactive University [21], the Dutch Digital University [22], and the NHS University [23]. Several others have dwindled more quietly, with no news emanating in English on the Web. Many reasons have been advanced for the far greater success of online education in the United States, greater than the higher gross domestic product alone should justify. Reasons suggested include the greater “travel to study” distances, a more “can do” culture, and more acceptance of private universities, both nonprofit and for-profit. Yet, in many European countries, initiatives continue—the Telematic Universities in Italy, the Campus Numériques in France, and the Swiss Virtual Campus collaboration (this latter example is coming to a planned end, not a failure). There is also an undercurrent of lower-profile but sound initiatives such as the private Hibernia College in Ireland; the U.K. universities of Derby, Leicester, Middlesex, Staffordshire, and Ulster; the collaboration of Liverpool University with Laureate Education Inc. to deliver master's programs; and, in addition, the various open universities across Europe rapidly reengineering themselves from distance learning to online learning. Similar initiatives have arisen in the community college sector in several other countries and regions such as England, Wales, Bavaria, and Norway. So, although many U.S. providers are looking

beyond the border and seeing very little competition, the global situation is likely to get considerably tougher in years to come, when competition for online students who live anywhere becomes as fierce as it is for traditional campus students.

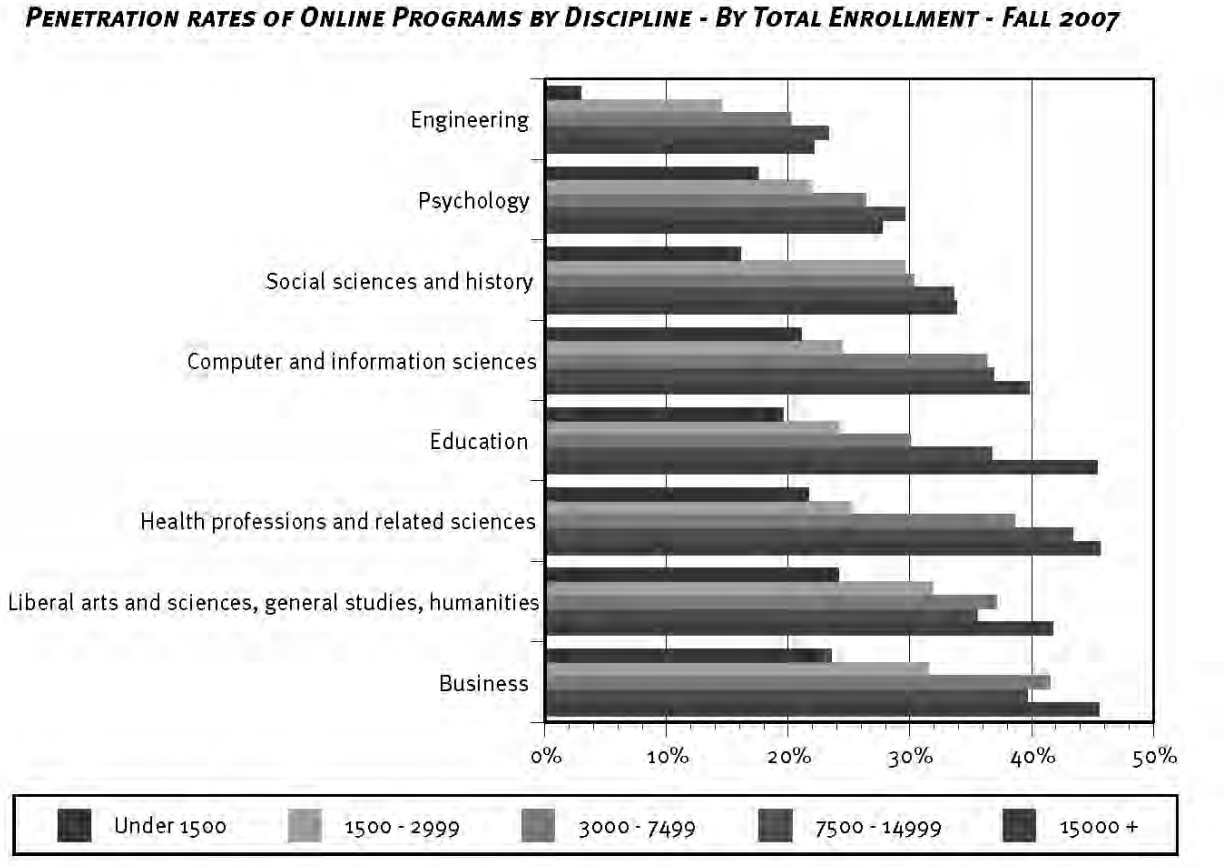


Fig. 1. Penetration of online programs by discipline and total enrollment, fall 2007. Data represent the results of the most recent Sloan Consortium national survey of all active, degree-granting institutions of higher education in the United States that are open to the public [24]. "Penetration" refers to the fraction of all online degree programs offered by such institutions as a fraction of all degree programs in that discipline. [Reproduced by permission of the Sloan Consortium]

REFERENCES AND NOTES

1. E. M. Noam, *Science* 270, 247 (1995).
2. See, e.g.; http://ocw.mit.edu/OcwWeb/web/home/home/index.htm.
3. See, e.g.; http://en.wikipedia.org/wiki/Learning_management_system.
4. Second Life; http://secondlife.com.
5. See www.sloanconsortium.org/publications/survey/index.asp.
6. C. Dziuban, P. Moskal, Educause Q. 24, 60 (2001).
7. J. Hartman, C. Dziuban, P. Moskal, in Online Education: Proceedings of the Sloan Summer Workshop on Asynchronous Learning Networks, J. R. Bourne, J. C. Moore, Eds. (Sloan Consortium, Needham, MA, 1999), pp. 155–179.
8. J. Fjermestad, S. Hiltz, Y. Zhang, in Learning Together Online, S. Hiltz and R. Goldman, Eds. (Lawrence Erlbaum, NY, 2005), pp. 39–80
9. R. Ragan, J. Kleoppel, J. Asynchronous Learn. Networks 8, 15 (2008).

10. National Center for Education Statistics, Digest of Education Statistics, 2007; http://nces.ed.gov/programs/digest/d07.
11. A. Finder, "Adjuncts outnumber tenured faculty on U.S. campuses," International Herald Tribune, 20 November 2007; www.iht.com/articles/2007/11/20/america/college.php.
12. A. Pickett, Faculty Development Process, Sloan-C Effective Practice; http://sloanconsortium.org/node/347.
13. E. Kashy, M. Thoennessen, Y. Tsai, G. Albertelli II, J. Asynchronous Learn. Networks 4, 231 (2000).
14. P. Shea, J. Asynchronous Learn. Networks 11, 73 (2007).
15. NASULGC-Sloan National Commission on Online Learning, Benchmarking Study: Preliminary Findings (2008); available at www.sloanconsortium.org/publications/survey/nasgulc-prelim.
16. Higher Education Opportunity Act, P.L. 110-315, 14 August 2008.
17. Accrediting commissions are nongovernmental agencies that conduct independent assessments of institutional quality and integrity. Certain accrediting commissions have sought and are recognized by the U.S. Secretary of Education as being "reliable" arbiters of institutional quality, and that approval is a requirement for institutional participation in the federal student financial aid programs.
18. See [16], section 495, paragraph 1.
19. Dow Lohnes; www.dowlohnes.com/postsecondary/accreditation.
20. P. Bacsich, Lessons to be learned from the failure of the UK e-University (2005); www.odlaa.org/events/2005conf/ref/ODLAA2005bacsich.pdf.
21. Megatrends in e-learning provision: E-learning initiatives which were discontinued because they failed to reach targeted goal: The Scottish Interactive University (2002); http://nettskolen.nki.no/in_english/megatrends/Discontinued/. Discontinued_ScottishInteractiveUniversity.pdf
22. See www.du.nl for a cryptic closure message (in Dutch).
23. D. McLeod, "NHS University axed," The Guardian, 30 November 2004; www.guardian.co.uk/education/2004/nov/30/highereducation.uk3.
24. I. E. Allen, J. Seaman, Staying the Course: Online Education in the United States, 2008 (Sloan Consortium, Needham, MA, 2008); www.sloanconsortium.org/publications/survey/pdf/staying_the_course.pdf.
25. The authors are grateful for helpful critiques from C. Dziuban at University of Central Florida and M. Goldstein of Dow Lohnes PLLC.

A CAUSAL MODEL OF FACTORS INFLUENCING FACULTY USE OF TECHNOLOGY

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

Yonghong Jade Xu
Counseling, Educational Psychology and Research
University of Memphis

ABSTRACT

Based on earlier studies using the 1999 and 2004 National Study of Postsecondary Faculty (NSOPF) data [1, 2], a causal model explaining faculty technology use was constructed. Path analysis was used to test the causal effects of age, gender, highest degree, discipline (health science or not), recent research productivity, and teaching load on faculty use of websites in teaching. Two models, one for faculty from Research I institutions and the other for faculty from Community Colleges, were tested and both models fit the data with satisfying indices. Results confirmed that age, highest degree, and teaching loads influenced technology use directly, but indicated the lack of relationship between research productivity and technology use in teaching. An additional connection is suggested from discipline to teaching load. One important difference between the two models is that the impact of gender and teaching load on research productivity is significant for faculty at Research institutions, but not for faculty at community colleges. The models confirm the consistent and relatively strong relationship of teaching load to faculty technology use.

KEY WORDS

Faculty Technology Use, Research Universities, Community Colleges

I. INTRODUCTION

Why is there such interest in whether and to what extent faculty use technology in higher education? Certainly, the interest may simply be because students come to college with an interest in the latest technologies [3] or that employers insist that students graduate with appropriate technical skills [4]. But it is also possible that technology has become, in the minds of some state and higher education leaders, a "silver bullet" that can solve higher education's problems of low productivity or poor performance [5, 6]. Clearly, higher education institutions are interested in seeing faculty use of technology increase as evidenced by a focus on faculty development, growth of distance education, and e-learning among the issues monitored in the annual survey of the top ten issues of Chief Information Officers compiled by Educause. While this research cannot answer definitively whether technology is that silver bullet, it does attempt to model the factors which affect faculty technology use. In other words, it investigates how technology comes to be used by faculty, but not whether it achieves all that has been ascribed to it.

II. REVIEW OF LITERATURE

Data on Faculty Use of Technology

Current data on faculty technology use indicates that faculty are increasing their use of technology. In a 1998 survey by the National Education Association [7], 70% of faculty had a computer at home, 25% had been involved with distance education, and 27% had a web site for their classes. It is very likely that these figures have increased to higher levels as use of course management software (CMS)—such as WebCT, Blackboard, or others that provide course materials and activities online—increased from 14.7% of the institutions answering the Campus Computing survey in 2000 to 33.6% of the institutions doing so in 2003 [8, p. 7). Two-thirds of the faculty in the University of Wisconsin system reported increased use of a CMS [9]. But other data paint a picture of faculty who are less involved in technology. For example, while 80% of public four-year institutions had course management systems (e.g., WebCT, Blackboard) in 2001, only 20% of courses taught by faculty used these systems [10]. Contrast these data with more recent data from the 2004 NSOPF that indicates 82% of faculty use email but only 50% used websites in their teaching. These data indicate an increasing, although not universal, use of various technologies by faculty. If faculty use of technology is to be encouraged, it is necessary to know what factors influence their use of websites in teaching. In other words, more research is needed to clarify their use of these new tools in professional activities.

Demographics and Workload

Because faculty technology use has been promoted as a "silver bullet," it is therefore important to understand which faculty come to use technology and the role of workload. Age and gender are widely thought to influence the use of technology. In national studies of the U.S. population, the Pew Internet and American Life Project have documented continuing differences in Internet use, but also a narrowing or elimination of those differences. Younger individuals use the Internet more frequently and more of them log in than older Americans [11]. However, for some specific activities (use email, get news, online purchasing), the different age groups are not that different. For example, 88% and 94% of Gen Y (18–28 year olds) and Leading Boomers (51–59) use email, 72% and 74% (respectively) get news online, and 68% and 67% (respectively) make online purchases. Males use online resources more than females, although black women and women under 30 exceeded their male peers in Internet use [12]. Women, however, are more "enthusiastic" [12, p. 1] online communicators, while men are more likely to perform transactions online, such as purchases and banking. In any case, it is clear that the genders are closing the earlier gap in Internet use. Given these research results, perhaps male and female higher education faculty are also becoming more alike in their use of technologies.

The impact of technology on workload has been amply documented [13, 14]. Workload increases through a number of processes, including learning new skills [15], spreading work time over a larger portion of the day because of increased use of email and course management systems [16]; keeping online courses up-to-date through continuous upgrading [15]; and increasing development time as learning goals ascend Bloom's learning taxonomy from knowledge to create [17]. In fact, for one individual, workload doubled [18] as preparation time increased as did one-to-one instruction; Brown [19] claimed a 40% to 50% workload increase; in another study, 76% of faculty surveyed spent more time preparing and delivering courses [20]. These results are duplicated on a larger scale: the National Center for Education Statistics [21] found that faculty teaching distance education courses actually had a higher teaching load (which may capture the higher teaching loads of community colleges where much distance education has occurred). In addition, faculty of distance education courses had higher average office hours and hours spent on student email per week [21].

An interesting insight into faculty perceptions can be drawn from studies on wholly online courses. Geith and Vignare [22] and Geith and Cometa [23] found that all of the surveyed faculty felt they spent more time when teaching online. However, when the researchers investigated the faculty's self-reported hours, only three of the nine online sections actually consumed more faculty time per student than more traditional courses. Five sections consumed about the same amount of faculty time and one section consumed less time. In a similar effort to understand why faculty believe technology increases their workload is Hislop's [24] study. Four faculty completed time logs while teaching two courses each—one online and one face-to-face—where both courses had the same curriculum. Instructional time did not differ much (333 hours online versus 347 hours face-to-face), but the online courses did take more time per student and interactions with students were spread out over more days in the week, rather than on the days when the class met [24]. It is interesting to see that the Geith et al. studies [22, 23] would indicate that faculty perceptions of how much time it takes to teach using technology are not reliable, but Hislop [24] would claim that faculty perceptions of time may be more credible when the analysis breaks down total time spent into per-student or other analyses. Or it may be that faculty perceptions about time spent online is different because they are also dealing with patterns of behavior or interaction that are different from earlier face-to-face experiences. Clearly, this is an area that requires further study.

Although the increases to workload seem to be sharp in the early stages (when learning new skills and developing new online resources occur), little research has been done on whether workloads decrease as faculty improve their skills and take advantage of a "learning curve." In this vein, Bartolic-Zlomislic and Bates [25] identified a rapid learning curve for faculty in three case studies of online programs that included time to learn the software to be used, how to design courses, and provide online instruction.

What is intriguing in most of the research on the relationship of technology and workload is that it is in one direction: in other words, technology increases faculty workload. Therefore, this study will focus on the causal relationship from teaching workload to technology use.

Models of Faculty Technology Use

The National Survey of Postsecondary Faculty (NSOPF:04) presents an opportunity to model faculty technology use by using the variables included in this national database. This dataset includes demographic variables of interest as well as several variables capturing workload, which seemed important for analyzing faculty technology use based on the research literature already reviewed. In other words, it is the best national database for this research and it has the further advantage of moving beyond the one-institution studies so prevalent in earlier research.

In two previous studies, Meyer and Xu [1] and Xu and Meyer [2] used NSOPF:99 and NSOPF:04 data to identify the factors that influenced faculty use of technology in their teaching. In the first study [1], hierarchical multiple regression analysis found that individual factors with a statistically significant relationship to faculty technology use included gender, age, highest degree type, teaching load, and research productivity [1]. Younger faculty, faculty with doctorates, and faculty with higher teaching loads were found to use email and the web relatively more in their teaching. Faculty with higher research productivity were found using email more often than websites. One limitation of the study was that interactions among variables were not investigated.

In the second study [2], institutional factors such as the institutional expenses, student full-time equivalent enrollments, faculty/student ratios were investigated along with individual factors. By including both sets of variables (a total of 40 separate variables) and using Bayesian networks to examine relationships among variables, the analysis resulted in a finding that differences in technology use were apparent for

faculty from different academic disciplines and for faculty employed by institutions of different Carnegie types. The most interesting results indicated that several variables capturing teaching (teaching as the individual's principal activity, student contact hours, percent time teaching, student credit hours taught) had significant and independent influences on technology use.

One consistent finding from both of these studies was the significant relationship between faculty teaching load and faculty technology use. With Bayesian analysis suggesting that teaching loads impact technology use, could it be that higher teaching loads send faculty members looking for technologies to use in order to do their job? This seems inconsistent with the literature on how technologies increase faculty workload, but both the importance and strength of this relationship indicate that in-depth investigation is needed into the causal relationships between workload and technology used in light of other related factors. Hence, this study tests a model that establishes the causal relationships between factors, including workload, influencing faculty technology use.

Proposed Causal Model

The causal model clarifies how individual and institutional factors—already found to be influential in Xu and Meyer [1] and Meyer and Xu [2]—interact and impact faculty use of technology in teaching. The proposed model is based primarily on these two studies. Rather than being a full-blown theory, the model (shown in Figure 1) is an abstraction that describes the probable causal relationships among significant factors that determine faculty use of technology. The plausibility and validity of the proposed model will be evaluated with the 2004 NSOPF data.

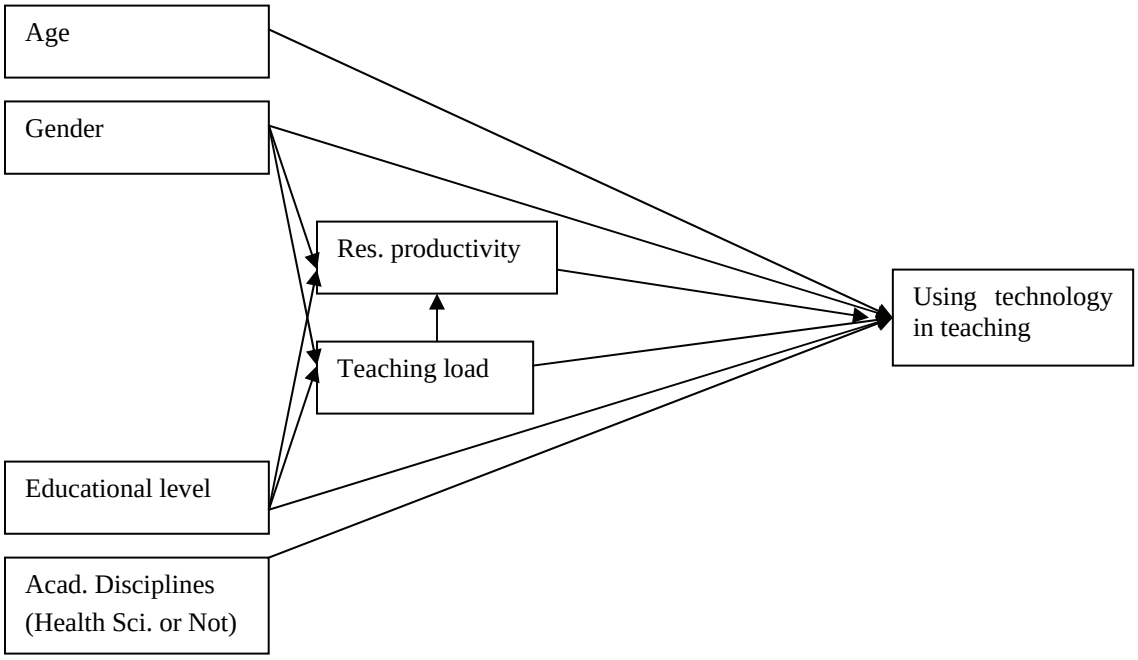


Figure 1. Proposed Causal Model of Faculty Technology Use in Teaching

With faculty technology use in teaching as the outcome variable, the proposed model suggests that there are direct effects from age, gender, education level, and academic discipline on this output measure. In addition to the direct effects, gender and educational level will have an indirect effect on technology use

through teaching load and research productivity, given that many studies have found that female faculty have heavier teaching loads, which leave them with less time to conduct research [26, 27]. Academic disciplines are related to faculty technology use [1], since some disciplines (e.g., health fields) had distinctive patterns of technology use in comparison to other disciplines (e.g., business, education). The model recognizes the impact of teaching load on research productivity, but not the reverse. The reverse relationship (that research productivity impacts teaching load) is theoretically viable, but so far has not been borne out by earlier analyses. The model also recognizes the critical organizing role of teaching load in its effect on technology use as an intermediary of gender and education level as well as having an independent influence.

Although a number of institutional influences on technology use (i.e., appropriations, enrollment size) were evaluated in [2], only the Carnegie classification of institutions was found to explain variations in technology use in teaching. However, rather than incorporate all Carnegie types into this model, the proposed model was evaluated separately for faculty in Research I institutions and compared to faculty in community colleges. In the NSOPF data, the 1994 and 2000 Carnegie classifications are available. The Research I institutions are classified in terms of the level of research activity, which is measured by factors including, among others, research and development expenditures and number of doctoral programs. Community colleges are two-year institutions that mainly confer certificates or associate's degrees (For more information, please visit http://www.carnegiefoundation.org/classifications/). Because of the distinct academic missions, faculty responsibilities are somewhat different. Research I institutions emphasize faculty research as well as teaching and service, and community colleges predominantly stress teaching [28, 29]. These two institutional types were chosen to focus on whether different expectations for faculty would play a role in faculty use of technology in teaching. How the model fits the two different faculty samples can shed more light on the causal effects between factors as well as the validity of the proposed model across institution types.

III. METHODOLOGY

A. Data Source

For this study, faculty members were selected if their principal activity was either teaching or research from the NSOPF:04 data. NSOPF:04 is the fourth national survey of postsecondary faculty sponsored by the National Center of Educational Statistics (NCES) since 1988. Even though the questions stay fairly consistent with minor modifications across surveys, a different sample of faculty was selected from the national pool in each survey. In the 2004 implementation of the survey, the original sample consisted of approximately 1,070 postsecondary institutions and more than 34,300 individuals employed in those institutions. The weighted response rate is 76% for the faculty survey. NSOPF surveys used complex sampling procedures including multi-level stratification and unequal probability selection of individuals. Following the discussion on data weighting of complex survey samples by Thomas and Heck [30], the data were weighted in both descriptive and inferential analysis. After data preprocessing, 2,748 faculty members from Research I institutions and 3,112 faculty from community colleges were included in the analysis.

B. Variables

The research objective is to propose and validate a causal model of factors determining faculty use of technology in teaching. Because the NSOPF:04 data showed that 82% of faculty members used email in their teaching [2], it is fair to conclude that email use has become the norm among higher education faculty. Thus, email use is not considered as an indicator of faculty adaptation of technology in this study.

Rather, the outcome variable capturing technology use will focus on the variable titled "website for any instructional duties" (coded as 0 for No, 1 for Yes). The original item in NSOPF:04 is worded in this way:

> Did you have one or more web sites for any of your teaching, advising, or other instructional duties? (Web sites used for instructional duties might include the syllabus, readings, assignments, and practice exams for classes; might enable communication with students via listservs or online forums; and might provide real-time computer-based instruction) [31, p. 23].

Table 1 presents the sample's distribution of faculty use of websites in teaching by gender and highest degree types. It shows that 61.6% of faculty members in Research I institutions used websites in their teaching, while only 39.1% of faculty in community colleges did so.

Table 1. Faculty Use of Website in Teaching by Gender and Highest Degree Type (Weighted)

Highest degree	Male		Female		Total	
	Count	% using website	Count	% using website	Count	% using website
	Research I institutions					
Doctoral	1520	67.0%	585	63.3%	2105	65.9%
Master's	192	49.3%	194	49.4%	386	49.3%
1st professional	143	41.1%	60	49.5%	203	43.6%
Bachelor's	30	53.3%	25	38.7%	55	46.6%
Total	1885	63.0%	863	58.5%	2748	61.6%
	Community colleges					
Doctoral	297	48.2%	162	51.9%	459	49.5%
Master's	973	38.1%	1034	41.3%	2007	39.8%
1st professional	55	34.0%	36	37.4%	92	35.3%
Bachelor's	312	28.9%	242	28.8%	554	28.9%
Total	1637	38.0%	1475	40.3%	3112	39.1%

Age is faculty members' biological age at the time of data collection (2003-04); gender is coded as 1 for male and 2 for female. To keep a parsimonious model structure, disciplines are simplified into a binary variable, health science disciplines (coded as 1) versus non-health-sciences disciplines (coded as 0), because faculty in health science disciplines were found to have distinct patterns from those in other academic areas when it comes to using technology in teaching [1,2]. Educational level is measured by highest degree type, which includes doctoral, master's, first professional, and bachelor's degrees (coded as 4, 3, 2, and 1, respectively). A few measures of teaching load were available in the NSOPF data, but "total student credit hours" was used in this study because increases in either the number of classes or the class sizes generally translate into an increase in teaching loads.

Last, because the causal model is a snapshot of faculty technology use at a certain point in time, it was decided to use research productivity in the last two years rather than career total research productivity. Measures of research productivity include the number of publications in juried journals, non-juried journals, books, book reviews, and presentations. It is difficult to justify eliminating any of these measures because different disciplines place different importance on them. Thus, an exploratory factor analysis (EFA) procedure was done to combine these variables of scholarly productivity into one more reliable measure of productivity. To be specific, one underlying factor was extracted that has an eigenvalue greater than 1 using a principal-components method. The scree plot also confirmed the single-factor structure because the extracted factor was separated by a clear "elbow" from the others that had

eigenvalues lower than 1. No rotation was needed to simplify the structure because only one factor was retained. Thus, the scores of the extracted factor, accounted for 36.4% of the total variance, was used as the measure of research productivity in the study.

C. Analytical Methods

The data were prepared in SPSS first and imported into LISREL 8.7 to perform path analysis by reconstructing the covariance matrices through maximum likelihood estimation and validate the proposed causal structure of faculty technology use. Separate path analyses were run for faculty in Research I universities and in community colleges; fit indices were examined for each model and parameter estimates studied. Then, a multi-group path analysis was conducted by imposing a cross-group equality constraint on the path estimates to determine whether the model direct effects differ significantly for faculty in Research I or Community College institutions. Maximum likelihood function was used to estimate the model parameters. Multiple model fit indices are discussed below. Since the available faculty samples are relatively large, $\alpha = .01$ is used for tests of significance.

IV. RESULTS

A. Overview of Results

Figure 2 shows the final path model of faculty technology use. In the process of path modeling, the direct effect from research productivity to technology use was removed due to non-significance. Also, an indirect effect was added from health science disciplines to faculty use of technology through teaching load as a result of analysis and further consideration of how teaching in the health science disciplines at research institutions may depend on technology to a lesser extent than other disciplines. This is an interpretation of the results that must be followed up with more detailed research. Statistically, the added path is supported by the single degree LaGrange-Modifier-based modification index that shows that the model χ^2 decreased by 8.40 to 11.43 with a reduction in the degrees of freedom by 1. In Figure 2, each path is marked with two numbers: the path coefficient (beta weight) for Research institution faculty before the slash (/) and the path coefficient for community college faculty after the slash. The standardized direct, indirect, and total effects of each variable on faculty use of websites are summarized in Table 2. In this section, the two models are presented separately. For each model, the fit is measured by four indices: χ^2 coefficient, root-mean-square error (RMSEA), standardized root mean square residual (SRMR), and comparative fit index (CFI). Note that dozens of model fit indices have been made available in LISREL. In general, they fall in three categories. First, absolute indices evaluate the overall discrepancy between observed and model-implied variance/covariance matrices; χ^2 and SRMR fall under this category. For good model fit, χ^2 is expected to be non-significant, although it may not be the case in many studies because it is a statistic that is very sensitive to sample size. SRMR needs to be lower than .08 for acceptable models. Second, incremental indices evaluate a model's absolute or parsimonious fit relative to the null model. CFI is one of them and must have a value greater than .95 for good model fit. Third, parsimonious indices evaluate the overall discrepancy between observed and model-implied variance/covariance matrices while taking into account the simplicity of the model structure. RMSEA belongs to this group and a value lower than .06 is desired [32]. The four indices reported in this article are selected based on a discussion in McDonald and Ho [33] and followed examples in other published SEM studies in higher education research. In addition to fit evaluation of the models for Research I institutions and community colleges separately, at the end of this section, the similarities and differences of the two models are also briefly discussed based on the multi-group analysis.

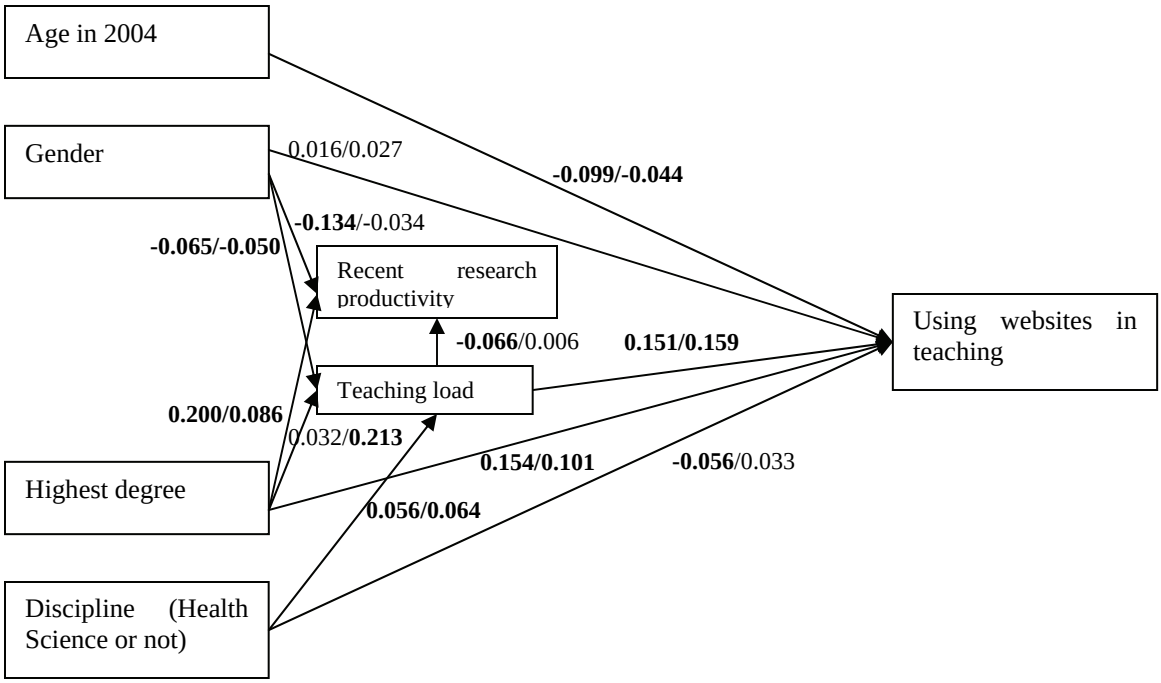


Figure 2. Path Analysis Model of Factors Influencing Faculty Technology Use

Notes. 1. The numbers marked on each path are "path coefficient for faculty in Research institutions/path coefficient for faculty in community colleges".

2. Numbers in bold indicate statistical significance at $\alpha = .01$.

3. R^2 for teaching load, recent research productivity, and using website in teaching is .008, .063, and .038, respectively for faculty in Research I institutions; and .049, .009, and .044, respectively for faculty in community colleges.

Table 2. Direct and Indirect Effects

	Standardized estimates					
	Faculty in Research I universities			Faculty in community colleges		
Variables	Direct effects	Indirect effects	Total effects	Direct effects	Indirect effects	Total effects
Age	**-.099**		**-.099**	**-.044**		**-.044**
Gender	.016	-.010	.006	.027	-.008	.019
Highest degree	**.154**	.005	**.159**	**.101**	.034	**.135**
H.S. disciplines	**-.056**	.008	**-.047**	.033	.010	**.044**
Teaching load	**.151**		**.151**	**.159**		**.159**
Recent research productivity						

Note. Numbers in bold indicate statistical significance at $\alpha = .01$.

B. Path Analysis Model for Faculty in Research I Universities

The path model of faculty use of websites in teaching has a RMSEA of approximately 0.026, which is nonsignificant ($p = 0.99$). The value of this index suggests an excellent fit of the proposed causal model to the observed data. The χ^2 coefficient is 11.43 with $df = 4$ and $p = 0.022$; given the large sample size, this is another positive sign of good model fit. The SRMR of this model is 0.012, which further confirms the model fit from the perspective of average magnitude of residuals. The fourth fit index, CFI = 0.99, also means the models fit the data quite well.

With the model goodness of fit confirmed, the path coefficients between the predictor and predicted variables show that the strongest predictor of faculty technology use is the highest degree type (0.154), although the indirect effect of highest degree on technology use through teaching load is not significant. Increase in teaching load (0.151) contributes significantly to greater use of websites in teaching. Age is also a significant predictor for technology use (-0.099), suggesting that older faculty are less likely to use the web while teaching. Faculty in the health sciences have a relatively higher teaching load (.056), but the indirect effect of discipline on technology use is weak (0.008). Given that discipline had a direct effect on website use (-.056), the total effect shows that faculty in health science disciplines use websites for teaching purposes significantly less than those in non-health-science disciplines. Gender is not a significant predictor of technology use (-.006). It is worth nothing that this model suggests that female faculty members had significant lower teaching loads (-0.065) and fewer number of publications than their male colleagues in the last two years (-0.134), while increased teaching load is found to lower research productivity (-0.066). Overall, 3.8% of the variance in faculty use of websites is accounted for by this path model.

C. Path Analysis Model for Faculty in Community Colleges

The same model structure explains community college faculty use of websites given that the model goodness of fit indices are RMSEA = 0.024 ($p = 1.00$), $\chi^2 = 11.43$ ($df = 4$, $p = 0.027$); SRMR = 0.011, and CFI = 0.99. However, the parameter estimates reveal that the magnitude of impact exerted by individual factors on faculty use of technology in this model is different from the model for faculty in Research I institutions. The strongest predictor of faculty technology use is teaching load (0.159): heavier teaching loads appear to drive professors to increase use of websites in teaching. The second strongest predictor is highest degree (0.101), indicating that faculty with higher education levels use technology more often. Older faculty use websites less in teaching (-0.044). Health science disciplines have a nonsignificant direct effect on technology use. However, combined with an indirect effect through teaching load, being in health science disciplines means community college faculty actually use more technology than their colleagues in other disciplines (0.044). Again, gender is not a significant predictor of technology use (0.019). Contradictory to earlier studies, female faculty actually had lighter teaching loads (-0.050); though, unlike faculty in Research I institutions, recent research productivity is comparable for both males and females for community college faculty. This may be due to the community college's lower emphasis on research for faculty, which equalizes the demand for research productivity for all faculty. Finally, possessing a higher degree meant heavier teaching loads (0.213) and more research productivity (0.086), but there is not a significant relationship between teaching load and research productivity. Overall, 4.4% of the variance in faculty use of websites is accounted for by this path analysis model.

D. Multi-Group Path Analysis

The same model structure appears to explain faculty technology use quite well in the two different institution types. Nonetheless, differences in path coefficients and explained effects warrant further examination of the cross-group model fit. Thus, a multi-group path analysis was run, in which cross-group equality constraints were imposed on the path estimates to determine whether the direct effects in

the unconstrained models, as previously discussed, differ by Carnegie type (Research vs. Community College). The analysis shows that the goodness-of-fit for the constrained models is substantially worsened (RMSEA = 0.257; SRMR = 0.21) when the two unconstrained models are compared. The poor fit of the cross-group model provides further evidence that observed differences in the parameter estimates and effects between the two unconstrained models are significant and that the factors driving faculty use of technology in teaching interact differently for faculty in Research I institutions and for faculty in community colleges as observed in the two unconstrained models.

V. DISCUSSION

This analysis has produced some intriguing results. First, the model as proposed and then refined appears reliable and sound. Age, degree level, discipline, and teaching load influence faculty use of technology, with teaching load being the greatest and most consistent influence. While the original model hypothesized an impact from research productivity to technology use in teaching, it was not maintained in the final model. This is difficult to explain without additional research being done that uses data collected to specifically explore this finding. It is possible that time spent on conducting research has little connection with using technology in teaching. Or, the relationship between research productivity and using the web in teaching could be obscured by contradicting forces. For example, experienced researchers may be able to put less effort into their teaching (assuming it takes some effort to employ websites in teaching) or perhaps the proliferation of course management systems make the use of the web in teaching easier and less time-consuming, therefore making it easier for busy researchers to use the web.

Another modification to the proposed model involved adding a link between academic discipline (health science or not) and teaching load. This is easy to understand considering teaching loads are different by discipline and health science faculty often work additional clinical or field rotations. It also adds to the importance of teaching load, which mediates all of the variables in the model except age.

There are differences between Research and Community College faculty and their use of websites in teaching. Discipline (health science or not) does not have significant direct effect on technology use for community college faculty, nor are gender and teaching load significant influences on research productivity, as befitting the community college's focus on teaching rather than research. Faculty in Research institutions produced significant relationships for disciplines (health science or not) on the use of websites in teaching as well as gender and teaching load on research productivity. In other words, the two types of institutions are different in their missions (i.e., their focus on teaching for community colleges versus teaching and research for Research institutions), and this difference is captured by the model. One of the reasons for retaining recent research productivity in the model is to capture its continuing importance for faculty in Research institutions, even if its impact on technology use is unproven.

There are many similarities between the two models, perhaps capturing some basic or foundational qualities of the faculty job that are true whether the faculty person is working at a Research institution or Community College. Age matters for technology use, with older faculty perhaps finding it more difficult to keep up with new technologies (which does not mean they are not willing or not able to learn). Highest degree also matters, as does teaching load. The more likely that faculty possess the doctorate and have a high teaching load, the more likely they will use websites in their teaching. But perhaps in contrast to early expectations that females used technologies less than males, gender did not have significant influence on faculty use of websites in teaching in either type of institution.

In this study, as the faculty person's teaching workload increased, the use of websites in teaching also increased. This may be capturing a need of faculty to seek new ways of teaching as demands on them grow. This finding of the connection of teaching load to technology use should not be construed to imply we advocate increasing teaching loads to encourage greater technology use. This would be a dangerous misinterpretation. It is not clear if faculty with higher teaching loads choose to adopt the use of the web in order to achieve some efficiencies in the use of their time or to lighten their load, so to speak. Or, this relationship may capture institutional pressures to teach more and use more technology, perhaps in response to budget problems, a need to address enrollment growth, or pressure from institutional leaders. There may also be a natural limit to how much web use can be incorporated into a busy teaching load; while course management systems might alleviate this problem, there is a practical limit to how much any faculty can accomplish within a 24-hour day. In other words, without paying attention to teaching faculty how and when to apply technology so that technology can help relieve pressures on their time, realizing greater teaching productivity (in terms of increased courses and/or enrollments) may not occur [34].

But what should institutions do based on this model? Should they increase teaching loads and only hire young Ph.D.s? Clearly not. However, they may decide to research the causal relationships of teaching load or research productivity on technology use and explore the conditions that could affect this relationship. Perhaps there are differences based on institutional type (e.g., small private liberal arts institutions) or disciplines which have different expectations for using technologies to teach. Second, institutions may want to consider exploring whether policies on faculty workload are affecting technology use or if there is a limit to this relationship.

As for future research, this model is based on both literature and previous studies conducted on the NSOPF 1999 and 2004 datasets. It explains the causal relationships among the variables, and does so with good model fit indices. But because the variance in faculty technology use explained by the models is not satisfactory, we need to continue to explore other hypotheses that may fit the data equally well or better. It is important to remember that the current model was developed and confirmed using a single database (NSOPF:04). In order to confirm, modify, or refute this model, future research needs to use more recent data and/or collect additional data elements that could fill important holes in the model.

It will be important to explore other mitigating or preexisting variables that may better explain the relationships in the model. There is literature on the roles of barriers to faculty using technology, including a loss of face-to-face, live interaction with students [35,36] and a lack of support or assistance to learn and implement the technologies [13,35,36,37]. Because the NSOPF:04 database does not include variables that capture these barriers, they could not be included in the model.

Future research ought to also explore how faculty motivations to use technology modify relationships in the model. Faculty are motivated to use technology in order to reach new audiences [35, 36, 38], to pursue an interest in learning new skills [36, 39], to enjoy the flexibility of the new approach [13, 35, 36, 39], and to stay up-to-date [35] and relevant [40]. Betts [41], Schifter [42, 43], and Rockwell et al. [14] explored the role of faculty's intrinsic and extrinsic motivations to use technology, and these motivations should be included in further research on the model in this research.

Furthermore, future research ought to explore the differences between Carnegie types and whether the individual's preference for teaching (or research) affects the institutional type they choose to work in and their willingness to use technology for teaching.

Finally, it is important for readers to keep in mind the limitations of this study when evaluating the findings. First, the causal model was generated using data from a national survey. Because the survey

relied on self-reported information, the research questions were answered with limited depth and breadth. Second, the model proposed in this study is based on the authors' understanding of the literature and knowledge about faculty work. Nonetheless, readers need to be aware that, even though the models fit the data with good indices, there could be other competing models that statistically fit the data equally well or better. Further research is needed in this area.

VI. CONCLUSIONS

So is faculty use of technology a silver bullet or not? Technology use is, as of 2004, widespread and almost universal for email. It is easy to understand why younger faculty use technology more than their counterparts, but it is less clear why teaching load influences technology use although it does so consistently despite different analytical approaches and statistical tools. The merits of this model lie in the extended understanding of factors influencing faculty technology use from personal level to institutional level (which includes differences resulting from discipline or institutional type), and statistically modeling their causal relationships that have not be done previously. It is worth noting that the final models are only one of the models that explained the data structure well, and there are possible alternatives that may explain faculty technology use equally well or even better thereby resulting in a higher R^2.

If technology was ever perceived as a silver bullet, it is a bullet whose trajectory is unknown, whose velocity is unknown, and whose arc and distance is unknown. In other words, while our understanding of the benefits of technology is emerging and we can state that technologies are certainly worthy tools, technology hardly qualifies for the status of a silver bullet that solves everything magically. Some problems it can help solve, although doing so will take effort, but solving all things will have to await the next silver bullet, if it exists.

VII. REFERENCES

1. **Xu, Y., & K. A. Meyer.** Factors explaining faculty technology use and productivity. *The Internet and Higher Education* 10(1): 41–52, 2007.
2. **Meyer, K.A., & Y. J. Xu.** A Bayesian analysis of the institutional and individual factors influencing faculty technology use. *The Internet and Higher Education* 10(3): 184–195, 2007.
3. **Oblinger, D. G.** Educating the net generation, no date. Available online at https://www.msmc.la.edu/Include/learning_resources/todays_learner/OneDayv2-HO.pdf.
4. **Woratschek, C. R., & Lenox, T. L.** Information Systems Entry-Level Job Skills: A Survey of Employers, 2002. Available online at http://isedj.org/isecon/2002/343a/ISECON.2002.Woratschek.txt.
5. **Greer-Pitt, S.** Distance learning: Silver bullet or educational apartheid? ERIC document ED466235, 2001.
6. **Twigg, C. A.** Is technology a silver bullet? *Educom Review* 31(2). Available online at https://www.educause.edu/pub/er/review/reviewArticles/31228.html.
7. **National Education Association.** *Quality on the line.* Washington, DC: Institute for Higher Education Policy, 2000.
8. **Green, K. C.** *Campus Computing 2003*. Encino, CA: Campus Computing Project, 2003.
9. **Morgan, G.** Faculty use of course management systems. ECAR Key Findings, 2003. Available online at http://net.educause.edu/ir/library/pdf/EKF/ekf0302.pdf.
10. **Lynch, D.** Professors should embrace technology in courses… *The Chronicle of Higher Education*, 48(19): B15–B16, January 18, 2002.
11. **Fox, S. & M. Madden.** Internet use and email. Pew Internet and American Life Project, 2005. Available online at http://www.pewinternet.org/pdfs/PIP_Generations_Memo.pdf.

12. **Fallows, D.** How women and men use the Internet. Pew Internet and American Life Project, 2005. Available online at http://www.pewinternet.org/PPF/r/171/report_display.asp.
13. **Betts, K. S.** Factors influencing faculty participation in distance education in postsecondary education in the United States: An institutional study. Ph.D. diss. The George Washington University, Washington, DC, 1998.
14. **Rockwell, S. K., J. Scheuer, S. J. Fritz, & D. B. Marx.** Incentives and obstacles influencing higher education faculty and administrators to teach at a distance. *The Online Journal of Distance Learning Administration* 2(4): 1999. Online at http://www.westga.edu/~distance/rockwell24.html.
15. **Adria, M. & T. Rose.** Technology, preprocessing, and resistance—A comparative case study of intensive classroom teaching. *Journal of Education for Business* 80(1): 53–60, 2004.
16. **Dziuban, C. D., J. C. Brophy-Ellison, & J. Hartman.** Faculty 2.0. *Educause Review* 42(5): 62–77, 2007.
17. **Brahler, C. J., N. S. Peterson, and E. C. Johnson.** Developing on-line learning materials for higher education: An overview of current issues. *Educational Technology & Society* 2(2): 1999. Available online at http://www.ifets.info/journals/2_2/jayne_brahler.html.
18. **Cavanaugh, J.** Workload and compensation considerations for online faculty. *Academic Leader* 22(7): 2006. Available online at http://www.magnapubs.com/pub/magnapubs_al/22_7/news/598995-1.html
19. **Brown, B. M.** Digital classrooms: Some myths about developing new educational programs using the Internet. *T.H.E. Journal*, 1998. Available online at http://thejournal.com/articles/1406_2.
20. **McKenzie, B. K., N. Mims, E. Bennett, & M. Waugh.** Needs, concerns and practices of online instructors. *The Online Journal of Distance Learning Administration* 3(3): 2000. Available online at http://www.westga.edu/~distance/ojdla/fall33/mckenzie33.html.
21. **National Center for Education Statistics.** *Distance education instruction by postsecondary faculty and staff: Fall 1998* (NCES 2002-155), 2002. Washington, DC: U.S. Department of Education.
22. **Geith, C., & K. Vignare, K.** Online degree programs: Service and cost. In J. Bourne and J.C. Moore (Eds.) *Online Education*, 203–211, 2001. Needham, MA: Sloan-C.
23. **Geith, C., & M. Cometa**. Cost analysis results: Comparing distance learning and on-campus courses, 1999. Available online at http://www.rit.edu/~609www/ch/faculty/CostStudy.PDF.pdf.
24. **Hislop, G. W.** Does teaching online take more time? Paper presented at 31st ASEE/IEEE Frontiers in Education Conference, October, Reno, NV, 2001. Available online at http://fie.engrng.pitt.edu/fie2001/papers/1198.pdf.
25. **Bartolic-Zlomislic, S., & A. W. Bates.** Investing in online learning: Potential benefits and limitations, 1999. Available online at http://bates.cstudies.ubc.ca/investing.html.
26. **Park, S. M.** Research, teaching, and service: Why shouldn't women's work count? In B. Ropers-Huilman (Ed.), *Women in Higher Education: A Feminist Perspective* (2nd Ed.), 285–308. Boston, MA: Pearson Custom Publishing, 2000.
27. **Stack, S.** Gender, children and research productivity. *Research in Higher Education* 45(8): 891–920, 2004.
28. **Thomas, S. L., and R. H. Heck.** Analysis of large-scale secondary data in higher education research: Potential perils associated with complex sampling designs. *Research in Higher Education*, 42(5): 517–540, 2001.
29. **Fairweather, J. S.** Beyond the rhetoric: Trends in the relative value of teaching and research in faculty salaries. *Journal of Higher Education* 76(4): 401–422, 2005.
30. **Fugate, A. L.** Career stages of community college faculty: A qualitative analysis of their career paths, roles, and development. *Community College Review* 28(1): 1–22, 2000.
31. **National Center for Education Statistics.** Faculty questionnaire. National Study of Postsecondary Faculty, 2005. Available online at http://nces.ed.gov/surveys/nsopf/pdf/2004_Faculty_Questionnaire.pdf.
32. **Hu, L. T., and P. M. Bentler.** Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling* 6: 1–55, 1999.

33. **McDonald, R. P., & M. R. Ho.** Principles and practice in reporting structural equation analyses. *Psychological Methods* 7(1): 64–82, 2002.
34. **Meyer, K. A.** Online program capacity: Limited, static, elastic, or infinite? *Planning for Higher Education* 36(2): 52–63, 2008.
35. **Berge, Z. L.** Barriers to online teaching in post-secondary institutions: Can policy changes fix it? *The Online Journal of Distance Learning Administration* 1(2): 1998. Available online at http://www.westga.edu/~distance/Berge12.html.
36. **Clay, M.** Faculty attitudes toward distance education at the State University of West Georgia, 1999. Available online at http://www.westga.edu/~distance/attitudes.html.
37. **McGee, P. A., & V. Diaz.** Wikis and Podcasts and Blogs! Oh, My! What is a faculty member supposed to do? *Educause Review* 41(5): 28–41, 2007.
38. **Barron, A. E. & C. Lyskawa.** A review of tools for developing and managing online courses. *Society for Information Technology and Teacher Education Annual*: 163–165, 1998.
39. **Mims, N. G., B. K. McKenzie, & E. Kirby.** How to simply involvement in on-line coursework. *Society for Information Technology and Teacher Education Annual*: 220–223, 1999.
40. **Mims, N. G.** Out of the ivory tower and into the chat rooms—are we giving in too much to technology? *The Online Journal of Distance Learning Administration* 2(3): 1999. Available online at http://www.westga.edu/~distance/mims23.html.
41. **Betts, K. S.** An institutional overview: Factors influencing faculty participation in distance education in postsecondary education in the United States: An institutional study. *The Online Journal of Distance Learning Administration* 1(3): 1998. Available online at http://www.westga.edu/~distance/betts13.html.
42. **Schifter, C.** Perception differences about participating in distance education. *Online Journal of Distance Learning Administration* 5(1): 2002. Available online at http://www.westga.edu/~distance/ojdla/spring51/schifter51.html.
43. **Schifter, C. C.** Factors influencing faculty participation in distance education: A factor analysis. *ED at a Distance* 13(1): 2000. Available online at http://www.usdla.org/ED_magazine/illuminactive/JAN00_Issue/Factors.htm.

VIII. ABOUT THE AUTHORS

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

Yonghong Jade Xu, PhD is Assistant Professor of Educational Research at the University of Memphis. She teaches graduate-level statistics in the College of Education and specializes in quantitative research methodology. Her research interests include the quality of faculty work life in postsecondary institutions, women faculty in science and engineering, statistics teaching and learning, and large-scale data analysis with multivariate and data mining approaches.

FACE-TO-FACE AND ONLINE PROFESSIONAL DEVELOPMENT FOR MATHEMATICS TEACHERS: A COMPARATIVE STUDY

Michael Russell, Rebecca Carey, Glenn Kleiman, & Joanne Douglas Venable
Boston College

ABSTRACT

The study compared the effects of a professional development course delivered in an online and a face-to-face format. The effects examined included changes in teachers' pedagogical beliefs, instructional practices, and understanding of teaching number-sense and related mathematical concepts. The study randomly assigned participants to either the online or the face-to-face format and employed the same instructors, reading material, and instructional activities for both formats of the course. Both formats of the course were also delivered over the same eight-week period and required participants to invest approximately the same amount of time each week engaging in learning activities. Both formats of the course showed significant impacts on teachers' mathematical understanding, pedagogical beliefs, and instructional practices. Consistent with prior research on online versus face-to-face instruction, the positive outcomes were comparable across both formats. Interestingly, teachers who participated in the online course reported that they were more willing to take courses in the future online than did teachers in the face-to-face condition. Further research is needed to determine whether this finding is limited to self-selected teachers, the specifics of this course, or other factors that limit generalizability.

KEY WORDS

Online Professional Development, Distance Learning, elearning, Online Facilitation, Self-paced Learning

I. INTRODUCTION

Online professional development provides several advantages over face-to-face sessions. In an online course, teachers have more flexibility and greater choice as to when they participate and engage in learning. Teachers in remote areas or who work in small schools can also gain access to professional development courses that would otherwise be expensive or impractical to deliver in a face-to-face environment. Through online courses, it is also easier to connect teachers across schools and districts, thus widening perspectives and fostering professional connections that would not occur otherwise. Nonetheless, since its introduction more than a decade ago, educational leaders have questioned whether professional development delivered in an online environment is as effective as traditional face-to-face sessions in increasing teachers' content and pedagogical knowledge and in improving their instructional practices.

The study presented here builds on past research that examines the effect that different design features of online professional development has on teachers' knowledge, pedagogical beliefs, and instructional practices [1, 2]. These previous studies systematically varied the level of interactions that occurred within different versions of a professional development course. One version included asynchronous, facilitated discussions among participants as a central, required part of the course while in the other version each participant worked independently, without a means of communicating with their peer participants. These studies also manipulated the amount and types of interactions participants had with the course instructors.

At one extreme, participants had access to two instructors, one with content area expertise and the other skilled in facilitating online discussions. Participants in this strongly facilitated online course received considerable amounts of feedback and had interactive discussions with the instructors throughout the course. At the other extreme, participants worked through the course at their own pace with minimal interaction with a single facilitator who handled technical and logistical questions but did not have content expertise. In this version of the course, participants were instructed to complete assigned readings, classroom activities, and writing assignments on their own and received a simple statement that their writing assignment was received and met the course requirements, with no constructive feedback or follow-up questions.

In both of these previous studies, the purpose of manipulating the level of interaction among participants and the amount and type of interactions with the course instructor(s) was to examine whether these design features influenced the intended outcomes of the course. All versions of the course were found to have comparable positive effects on teachers' pedagogical beliefs, instructional practices, and knowledge of teaching algebra (the focus of the course). Surprisingly the positive effects did not differ significantly among the different versions of the course.

As described more fully below, the study presented here shifts the focus of our research from manipulating aspects of an online course to directly comparing the effects of online versus face-to-face courses in which the goals, content, and activities are kept as comparable as possible. In the sections that follow, we provide a brief review of prior research on online professional development that informed the design and focus of the study presented here. We then describe the course and the design of the face-to-face and online versions of the course. We then describe the methodology employed to recruit and assign teachers to groups, as well as the data collection instruments employed for this study. Finally, we present the study findings and explore the implications these findings may have for the design and delivery of online professional development.

II. SUMMARY OF PAST RESEARCH

Since the early 1980's, there has been a lack of consensus about whether online instruction affects learning as well as face-to-face instruction. Believing that technology is a neutral carrier of content, Clark [3, 4] argues that the use of a given technology for instructional purposes should not affect learning outcomes. Other researchers, however, argue that computer-based technologies have potential to be transformative [6, 7, 8]. In the context of professional development for K–12 teachers, the use of technology to delivery professional development courses in an online forum offers several potential advantages over face-to-face instruction.

In contrast to the spontaneous verbal communication of face-to-face learning environments, asynchronous learning environments in which communication is primarily written may provide conditions that promote reflective inquiry [9, 10, 11]. Threaded discussions available in online environments differ from face-to-face discussions in that they enable exchanges across time and space, provide a permanent record of interactions, and allow participants more time to reflect on a given topic before responding [9]. While there are elements of real-world conversations in threaded discussions, there is nothing analogous to threaded discussions in the real world [12].

In a 5-year longitudinal case study, Delfino and Persico experimented with different techniques for teacher professional development including a face-to-face approach, an online approach, and a blended approach [13]. Although the general objectives of the face-to-face and online courses were the same, Delfino and Persico found the online approach, which was free from time constraints and maintained a record of written interactions, promoted critical thinking and in-depth reflection on content. Similarly, when comparing

discussions of graduate students in an online environment with those in a face-to-face environment, Meyer found that the use of threaded discussions increased the amount of time learners were engaged in discussions related to class objectives [14]. Meyer indicates that learners in an online medium spent more time reflecting on course material, asking questions, and engaging in discussions about the course content. Given the speed with which face-to-face discussions occur and evolve, Meyer also suggests that online threaded discussions may benefit learners who require additional time and reflection to construct knowledge.

Despite the potential benefits that online discussions may have for supporting student learning, Garrison argues that when online learning simply recreates the conditions of a traditional classroom, it fails to exploit the unique strengths of online learning [9]. While researchers have reached a broad consensus on the general components of high-quality K–12 teacher professional development in face-to-face contexts, many questions remain about the design and delivery of effective online professional development [15].

Several recent studies have focused on the characteristics of existing OPD programs, but little research has examined specific OPD formats and their impacts on teacher practice and student learning [16, 17, 18]. Ginsburg, Gray, and Levin reviewed the quality and effectiveness of more than 40 online professional development programs, judging them against what is known about similar evidence for effectiveness and quality in traditional face-to-face professional development [17]. Overall, Ginsburg et al. found that the OPD sites lacked rigorous independent assessments of the impact of OPD on teacher or student outcomes. Similarly, in a review of the literature on professional development for teachers, Lawless and Pellegrino concluded that success of professional development is typically judged from anecdotal evidence or the results of surveys in which teachers indicate their satisfaction with the experience or their perception of its usefulness to their work [16]. Consequently, researchers know what teachers *think* about their professional development activities, not what they actually learn, how it changes their pedagogies, or how it impacts student learning [16].

Two recent studies, however, systematically varied specific characteristics of a professional development course and examined the impact on learning outcomes. In both studies, the learning goals, the course materials, and the assignments participants were required to complete were identical. In the first study, the course was delivered in two formats. For the first format, the course was led by a course facilitator who actively participated in discussions, guided participants through the course material in a paced manner, and encouraged interactions among participants through a threaded asynchronous discussion forum. For the second format, participants did not have access to a threaded discussion board, were unable to communicate with other participants via email, had limited discussions with the course instructor, and completed the course material at their own pace [1].

The second study contrasted four conditions. One was a highly supported condition, with a math education instructor, an online facilitator, and asynchronous peer interactions among participants as they worked through the course together. Another was a self-paced condition, in which participants did not have access to a math education instructor, could not communicate with other participants through online discussions or email, and simply submitted assignments to the instructor who did not provide any specific feedback to participants. A third condition included threaded discussions but were led by an online facilitator who did not have expertise in math education instruction. The fourth condition allowed participants to communicate online with an instructor with expertise in math education instruction, but participants were not able to communicate with each other [2]. Both studies found that all versions of the course had positive effects on teachers' beliefs about math instruction, on their practices (as reported by themselves and their students), and on their understanding of mathematics instruction as measured by a mathematics test. Surprisingly, both studies also found that the positive effects did not differ among the conditions. Regardless of the level of

facilitation, the level of expertise of the instructor, the pacing of the course, or the level of interaction among participants, the course had the same positive effects on teachers' pedagogical beliefs, instructional practices, and increased knowledge of teaching mathematics [1, 2].

This finding parallels findings from several studies that have compared the effects of traditional face-to-face instruction versus online instruction. Although small, this body of research consistently reports that no significant difference in learning outcomes occur between courses delivered in face-to-face or online modes [19, 17, 20, 21]. The study presented here extends the two previous studies that compared the effects of various online conditions, and seeks to expand the body of research that compares the effect that the mode of delivery, that is online versus face-to-face, has on the intended learning outcomes of the course.

III. BUILDING A SYSTEM OF TENS COURSE

The course employed for this study was titled *Building a System of Tens*. The course was originally developed by Deborah Shifter and her colleagues and is Part I in a series called Developing Mathematical Ideas (DMI). For the purposes of this study, the face-to-face version of this course was adapted by the Education Development Center to create an online version.

For the study presented here, both the online and face-to-face versions of the course required teachers to read the same material, experiment with the same activities in their classroom, and complete the same assignments within an eight-week period. In addition, to control for the potential effect of instructor quality, the courses were run by the same set of facilitators, each of who facilitated one face-to-face session and one online session. The intended learning outcomes of the course were also the same for both versions. These outcomes included the following:

Increased understanding of number sense.

Increased ability to identify misconceptions and errors that students apply when working on problems specific to number sense.

Increased ability to identify and apply instructional strategies that hold potential to help improve student understanding of these concepts.

Increased use of instructional methods that allow students to develop their thinking, share their understandings, and discuss their classmates' problem-solving strategies.

What differed between the two versions of the course was the mode in which the course was delivered. In the version we term "online", participants logged on to the course website to access course materials. The course website's discussion board provided the platform for participants to communicate with other course participants and the course facilitator. The online course followed a weekly schedule and participants were expected to spend three hours each week interacting online with their peers and completing course activities. Each online cohort had two course facilitators: one content expert and one online facilitation expert. The content facilitator provided individualized, instructional feedback on assignments and other direct instruction as needed. The content facilitators where experienced mathematics educators who had been trained in the DMI approach by the original course authors. The primary duties of the online facilitation expert were to send welcome and twice-weekly reminder e-mails, track participation, and provide technical assistance when the need arose. Course participants were given the email addresses and phone numbers of their course facilitators. The content facilitator followed the same syllabus employed by the face-to-face participants. Participants completed assignments weekly and submitted them to their content facilitator. These participants downloaded all course material and viewed videos online.

In the second version, which we term "face-to-face", participants attended weekly class sessions throughout the 8-week duration of the course. Each class lasted for approximately three hours. The face-to-face cohort had one course facilitator trained and experienced in DMI. Participants were given the email address and phone numbers of their course facilitators. While some participants contacted their facilitator via phone and email, the vast majority of the interactions occurred during class periods. The course facilitator followed a syllabus that was identical to that used for the online version. The facilitator provided individualized, instructional feedback on assignments and other direct instruction as needed. Participants were expected to complete weekly assignments and bring these assignments to class. Participants spent much of the class sessions working in small groups with other teacher participants. Some teachers independently exchanged email addresses with one another and communicated outside of class.

It should be noted that participants in both versions of the course were awarded graduate course credit and a stipend of $200 for participating in the course and completing all of the data collection instruments described below.

IV. STUDY DESIGN

The study presented here was designed to compare the learning outcomes of the same course delivered online or face-to-face. To limit class size, a total of six sections of the course were delivered, three online and three face-to-face. In addition, three facilitators with content-area expertise were hired to run the sessions. To control for the effect that a facilitator may have on the learning outcomes of the course, each facilitator ran one online version and one face-to-face version.

Participation in the study was limited to teachers in grades one through five who were currently teaching mathematics. Because one version of the course required teachers to meet face-to-face, three geographic areas were targeted, namely schools within easy driving distance of Bourne, MA, Newton, MA, or Manchester, NH. Principals of schools within easy driving distance of the targeted geographic areas were asked to invite teachers in grades 1 through 5 to participate in the professional development course. One hundred and fifty teachers who met the following criteria were selected to participate in the study:

sCurrently teach math to elementary level students, and;

Have a working email address, and

Have access to a classroom of students with whom to work.

Teachers were stratified by geographic location and gender, and then randomly assigned to one of the two treatment groups: face-to-face or online. The face-to-face cohorts contained 21 teachers in Manchester, 16 teachers in Bourne, and 18 teachers in Newton. The online cohorts contained 28 teachers in Manchester, 35 teachers in Bourne, and 32 teachers in Newton. Note that the online versions were assigned a larger number of teachers because prior research indicated that approximately 40% of teachers taking the online courses did not complete the course. While we did not have data on the drop-out rate for face-to-face courses, we assumed that the drop-out rate would be smaller for face-to-face. Thus, to yield approximately the same number of participants in both settings at the end of the study, a larger percentage of teachers were randomly assigned to the online courses.

V. DATA COLLECTION INSTRUMENTS

The study presented here focused on the effect that the two versions of a professional development course had on the intended outcomes of the course. To collect data about the intended outcomes, six instruments were employed. These instruments included a background survey, a pedagogical beliefs and practices survey, a measure of teachers understanding of teaching the base ten number system, a student survey, a

teacher log, and a course evaluation. As shown in Table 1, the background survey, pedagogy survey, teacher log, and the mathematics assessment were administered prior to the start of the course. The pedagogy survey, mathematics assessment student survey, teacher logs, and course evaluation were administered after the course was completed. Below each of the instruments is described briefly and pdf versions of the instruments are available at http://www.bc.edu/research/intasc/researchprojects/optimizingOPD/OPD.shtml.

Table 1: Instrument List

Instrument	Administered Pre-course	Administered Post-course
Background Survey	X	
Pedagogy Survey	X	X
Math Assessment	X	X
Student Survey	X	X
Teacher Log	X	X
Course Evaluation		X

A. Background Survey

The background survey was designed to collect demographic information and information about each teacher's prior experiences with professional development and technology use. The majority of the items on the background survey were closed-response. In a few instances, participants were requested to type in numeric values. In addition, the background survey contained items that were used to form four scales. These scales and their associated reliabilities included Prefer to Work on a Team (.78), Prefer to Learn on Own (.69), Proactive Regarding Own Professional Development (.56), and Access to and Use of Technology (.70). Each of these scales was standardized to have a mean of zero and a standard deviation equal to one.

B. The Peda*g*ogy Survey

The pedagogy survey collected information about teachers' pedagogical beliefs and instructional practices, and was administered prior to and following the completion of the course. All items were closed-ended and asked teachers to either report the frequency with which they employed specific instructional techniques or to indicate the degree to which they agreed or disagreed with a statement that focused on the value of a given instructional practice. The vast majority of items employed for this survey were taken from two previous studies that focused on the relationships between pedagogical beliefs and practices and the use of instructional technology in the classroom [22, 23]. The specific scales that were formed and the associated reliabilities included Teacher Confidence Teaching Mathematics (.84), Student-Centered Beliefs (.80), Teacher-Directed Beliefs (.56), and Comfort Recognizing Students Problem Solving Strategies (.86). Scores for each scale were formed by calculating each teacher's mean response using a four-point scale that ranged from 1 (low score value) to 4 (high score value).

C. Math Assessment

The math assessment was designed to collect information about teachers' understanding of the base ten number system and related concepts covered in the professional development course. The assessment was administered twice, once in the first week and once in the final week of the course. The assessment

included a set of multiple-choice items and open-response items that presented teachers with a sample of student work for a given problem specific to the base ten number system. The teacher was then presented with two sets of open-response items. The first set of three open-response items presented examples of student work and asked the teacher to explain the method the student used to acquire their answer and to evaluate whether the method makes mathematical sense. The second set of items presented the teacher with work performed by two students and asked the teacher the following questions: a) Explain what the students might have been thinking. Why does this method give the wrong answer? and b) As their teacher, what is an approach that you might take to help students understand why this method doesn't work? Include examples to clarify your approach. Using a scoring guide that was shown to yield reliable scores (inter-rater reliability of .80 or higher), two readers independently scored teacher responses and, when discrepancies occurred, the readers discussed their scores before reaching a consensus score. The scoring guide employed the following four-point scale: (0) does not meet expectations; (1) partially meets expectations; (2) meets expectations; and (3) exceeds expectations.

D. Teacher Logs

The teacher logs were designed to capture information about teachers' day-to-day pedagogical practices. The teacher logs were administered twice, once during the first week of the course and once during final week of the course. During each administration, teachers completed three logs. Each log consisted of a series of instructional strategies similar to those explored in the course. For each strategy, teachers were asked to indicate whether the strategy was: (1) not used at all; (2) a minor component of the lesson; (3) a major component of the lesson; or (4) the most important component of the lesson. The ratings provided for each activity were then averaged across the logs recorded for each week.

E. Student Survey

To triangulate data provided by teachers via the pedagogy survey and the teacher logs, a survey was administered to students in the teacher's mathematics classroom. The study survey was administered twice, once prior to the start of the course and once following the completion of the course. The survey asked students to indicate the frequency with which they engaged in specific learning activities (e.g., performing worksheets individually, working with partners to solve problems, sharing solutions with their class, etc.) and how often their teacher employed specific instructional strategies (e.g., asking students to explain how they solved a problem, showing students how to solve a problem, asking students to respond to each others work, etc.). All items were forced-choice and were used to measure the frequency with which students and their teachers engaged in specific instructional and learning activities. The scale employed for these items ranged from: (1) almost always; (2) most of the time; (3) once in a while; and (4) never. Hence, a low score for a given item indicated more frequent use of the given instructional strategy.

F. Course Evaluation

The course evaluation was designed to collect information from teachers about the positive and negative aspects of the course. The course evaluation instrument asked participants to rate the value and quality of various aspects of the course including the reading material, the assignments, the facilitator, feedback on assignments, etc.

VI. FINDINGS

The primary research question examined in this study asked whether the mode of delivering the course—online versus face-to-face—affected teachers' mathematical understanding, their pedagogical beliefs, and their instructional practices. To this end, the majority of analyses conducted for this study focused on comparing the effect of the two versions of the course on these three outcomes. But, to provide a better

understanding of characteristics of the study participants, descriptive statistics were calculated for several items on the background survey. We begin, then, with results of the background survey.

G. Characteristics of Study Participants

The majority of teachers who participated in and completed the study were female (95%). The vast majority of teachers also identified themselves as white (93%). The age of participants was distributed fairly evenly across age groups, with 6% 25 years or under, 11% 26–30 years, 11% 31–35 years, 13% 36–40 years, 12% 41–45 years, 19% 46–50 years, 15% 51–55, and 14% older than 55. There were wider differences in the number of years participants reported that they had worked as a teacher. Six percent had taught for less than one year, 26% for 1–5 years, 18% for 6–10 years, 21% for 11–15 years, 8% for 16–20 years, 9% for 21–25 years, and 12% for more than 25 years. The vast majority of teachers reported that they did not have either a minor or a major in mathematics (93%), but did have full credentials for teaching in an elementary school (84%) and had a Masters degree (66%). Sixty-two percent of teachers also reported taking 1–5 professional development courses related to mathematics during the previous three years.

A t-test was conducted on each of these background variables and on the four background scales to examine whether the treatment groups differed with respect to their demographics and prior educational and work experiences. No statistically significant differences between the groups were found for any of the background variables.

H. Completion Rate

Of the 150 participants who agreed to participate in the study, 24 opted not to participate once they were notified of the treatment to which they were assigned. No data was collected from teachers who opted not to participate in the study. However, it is interesting to note that several of the teachers who opted not to participated noted that they were hoping to take the course online.

The actual number of teachers who began the study was 126. Of those, an additional 45 teachers either did not complete the course or did not complete the data collection instruments. Thus, of the teachers who initially agreed to participate in the study, 54% completed all components of the study. Of those teachers who actually began a course, 64% completed. While these completion rates are lower than we anticipated, they were consistent with past research on online professional development. As an example, the drop out rates for the two studies upon which this research builds were 46 and 44% [1, 2].

Table 2 displays the drop-rates for each session of the course. For two of the three face-to-face sessions, the drop-out rate was noticeably lower than the online courses. However, the third face-to-face cohort experienced the largest drop-out rate of all sessions.

Table 2: Drop-out Rates within Each Session

	Face-to-Face			Online		
	Manchester	**Bourne**	**Newton**	**Manchester**	**Bourne**	**Newton**
Drop-out Rate	14%	20%	67%	32%	60%	47%

Across cohorts, participants who did not complete the course were sent a survey inquiring about the reasons for their non-completion. Twenty-one drop-outs responded. Thirty percent of those drop-outs who responded indicated that personal reasons, such as family health issues or divorce, made it too difficult to participate in the course. Twenty-four percent of respondents indicated that the demands for the course were too high and an additional 19% stated that the time commitment was larger than they had anticipated.

Chi-square analyses were performed to examine differences in background characteristics for students who dropped-out and those who participated. Statistically significant differences were detected for four items. First, while 33% of those who completed the course reported that they had taken a course on the base ten number system previously, 67% of drop-outs had done so. This may indicate that the content of the course was more familiar for those who dropped out than it was for those who persisted. Second, a higher percentage of teachers who persisted through the course stated that they tend to complete tasks and assignments before deadlines. Third, a higher percentage of teachers who persisted through the course stated that they strongly value learning by seeing visual images such as pictures or movies. Finally, teachers who dropped-out of the course reported that they had taken more professional development courses related to teaching mathematics over the past three years as compared to those teachers who persisted. It is important to note that no statistically significant differences were found for characteristics such as preference to work on a team, preference to learn on own, being proactive regarding own professional development, and access to and use of technology. Finally, of those participants who dropped out, none of the background characteristics differed significantly between those who were in the face-to-face or the online version of the course.

I. Quality of the Course

Overall, participants believed that both versions of the course were well developed, well delivered, and valuable. Across all items on the survey that asked participants to rate the value of specific components of the course and the course overall using a four point scale that ranged from not valuable to very valuable, the mean fell between the *valuable* and *very valuable*. As a few examples, when asked to rate the value of the case studies, the mean rating was 3.67 with 4 representing "very valuable." When asked to rate the value of the expertise and feedback from the facilitator, the mean rating was 3.45. And when asked to rate their learning in the course compared to their previous face-to-face professional development opportunities, the mean rating was 3.82.

To examine whether participants in the online and the face-to-face groups had similar views about the course, a series of t-tests were conducted for each item on the end-of-course evaluation. After adjusting for multiple comparisons, a statistically significant difference was found for five items. Specifically, as one might expect, teachers in the online version of the course reported experiencing more technical problems while taking the course than did teachers in the face-to-face group ($t=3.20$, $p<0.01$). Teachers in the face-to-face version also reported a higher value for performing the assigned math activities ($t=4.72$, $p<0.01$), sharing ideas with other participants ($t=3.18$, $p<0.01$), and receiving feedback from their facilitator ($t=3.27$, $p<0.01$). For all three of these items, however, the mean rating for both groups was above 3, indicating that both groups believed each of these were valuable. The final difference occurred on an item that asked, "If given a choice, I would prefer to take a course like this face-to-face as opposed to online." The scale for this item ranged from 1 (strongly disagree) to 4 (strongly agree). The mean rating for teachers in the face-to-

face group was 3.41, while the mean rating for the online course was 2.40 ($t=4.41$, $p<0.01$). Clearly, those teachers who experienced the course in a face-to-face environment indicated that they would prefer this version in the future. In contrast, teachers who experienced the online version seemed less enthusiastic about taking a similar course in a face-to-face environment.

J. Changes in Pedagogical Beliefs

The Pedagogy Survey was designed to collect information about teachers' pedagogical beliefs. The survey was administered pre-and post-course, and the data was used to examine changes in teachers beliefs and practices that followed their participation in the course. It should be noted that the scale scores ranged from 1 (low value) to 4 (high value). Table 2 displays the mean scale scores for each treatment group for the pre- and post-course administrations. The column labeled Change displays the change in mean score between the pre-course and post-course administrations. For the teacher confidence teaching math, student-centered beliefs, and comfort recognizing students' problem solving strategies scales, teachers scale scores increased significantly. While there was a slight decrease in teacher-centered beliefs, this change was not statistically significant. There were no statistically significant differences between the face-to-face and online groups for any of the pedagogical belief scales.

Table 2: Scale Score Difference between Pre- and Post-survey, Grouped by Treatments

	Pre	Post	Change (Post – Pre)	*p*
Teacher confidence teaching math	2.85	3.39	.54	<.01
Teacher-directed beliefs	2.58	2.52	-.06	0.50
Student-centered beliefs	3.75	4.15	.40	<0.01
Comfort Recognizing Students' Problem Solving Strategies	2.13	2.95	.82	<0.01

K. Changes in Instructional Practices

Teachers completed three teacher logs prior to the course and three logs following the completion of the course. As described above, the logs asked teachers to indicate the extent to which each type of activity was a component of the logged lesson. Table 3 displays the mean ratings given by teachers across lessons logged prior to and following the course. The column labeled post-pre indicates the change in the mean rating between the pre-course logs and the post-course logs. Within the face-to-face group, the extent to which these twenty-seven instructional strategies were elements of lessons changed significantly for fifteen strategies. Two of these strategies—having students do worksheets and stopping class to address discipline—saw declines in their occurrence. The remaining thirteen strategies experienced increases. Among the strategies that experienced increases were: developing and adapting instructional material; asking students to make conjectures, draw pictures, write about math, work with manipulatives, or solve problems related to everyday life; leading whole class discussions and asking follow-up questions to students' responses; and asking students to work in pairs or groups to solve problems. For the online group, significant changes were found for sixteen strategies. Half of these strategies were the same as those that saw changes in the face-to-face group. Only one strategy experienced a significant decrease—having students work independently. The remaining strategies experienced increases.

Independent sample t-tests were conducted to compare the amount of change that occurred for each item between the two groups. After adjusting for multiple comparisons, a significant difference was found for only one item—having students work independently. For this item, the face-to-face group experienced a small increase in reported use while the online group reported a significant decrease. The fact that a

significant difference was found for only one of twenty-seven items suggests that the two versions of the course had similar effects on the use of many instructional practices explored during the course.

Table 3: Summary of Teacher Log Mean Scores by Treatment Group

	Face-to-Face (n=36)				**Online** (n=49)			
	Pre	**Post**	**Change**	***p***	**Pre**	**Post**	**Change**	***p***
Review material	2.88	3.12	0.24	0.06	2.89	3.05	0.16*	0.05
Adapt material	2.83	3.08	0.25*	0.05	2.89	2.91	0.02	0.80
Develop new material	2.30	2.55	0.25*	0.03	2.21	2.35	0.14	0.24
Analyze students work from prior lessons	2.75	2.83	0.08	0.34	2.70	2.93	0.23*	0.03
Examine examples of teaching in the form of vides, case studies, etc.	1.31	1.63	0.31*	0.01	1.30	1.72	0.42*	<0.01
Design assessment tasks	2.12	2.60	0.48*	0.00	2.35	2.35	0.01	0.96
Collaborate with other teachers in preparation for lesson	1.86	1.83	-0.03	0.84	2.03	2.21	0.18	0.17
Solve problems and consider alternate strategies students may use	2.86	2.98	0.12	0.39	2.71	2.99	0.28*	0.01
Have students do introductory drills	2.39	2.31	-0.08	0.62	2.52	2.30	-0.22	0.04
Ask students to make conjectures	2.70	2.97	0.27*	0.03	2.92	3.01	0.09	0.39
Ask student to use drawings or pictures to solve or explain a problem	2.78	3.14	0.36*	0.05	2.88	3.23	0.35*	0.01
Ask students to use words to present an answer	3.02	3.38	0.36*	0.01	3.05	3.29	0.24*	0.02
Have students review homework	2.06	1.82	-0.24	0.07	2.03	1.93	-0.10	0.40
Work with manipulatives	2.26	2.81	0.55*	0.01	2.75	3.09	0.34*	0.01
Ask follow-up questions to students' responses	3.16	3.46	0.31*	0.01	3.13	3.41	0.28*	0.00
Lead whole class discussions	2.91	3.23	0.32*	0.01	2.97	2.98	0.01	0.91
Demonstrate/explain concepts to whole class with manipulatives	3.09	3.14	0.05	0.72	3.10	2.95	-0.16	0.08
Have students do worksheets	2.25	1.89	-0.36*	0.01	2.09	2.07	-0.01	0.91
Have student work on independent, long-term projects	1.26	1.32	0.06	0.53	1.24	1.41	0.18*	0.03
Ask students to solve problems presented in the context of everyday life	2.51	2.94	0.43*	0.01	2.55	3.00	0.45*	0.00
Have students work independently**	2.80	3.01	0.21	0.13	2.85	2.41	-0.44*	0.00
Have students work in pairs or small groups	2.93	3.21	0.29*	0.04	2.80	3.09	0.29*	0.00
Have students respond to one another	2.84	2.97	0.13	0.39	2.59	2.93	0.34*	0.01
Have students work together on problems for which there is no immediately obvious method or solution	1.54	2.00	0.46*	0.01	1.69	2.00	0.31*	0.02
Administer a multiple-choice test/quiz	1.18	1.08	-0.09	0.19	1.12	1.26	0.14*	0.02
Administer an open-ended test/quiz	1.30	1.20	-0.09	0.35	1.29	1.44	0.15	0.15
Stopped class to address discipline	1.58	1.36	-0.22*	0.01	1.60	1.56	-0.04	0.52

* Change within group statistically significant at p=.05.
**Change between groups statistically significant at p=.05.

L. Student Survey Results

Similar to the teacher logs, analyses of the student survey focused on responses to individual items. For each item, the mean response for students within each class was used to estimate the frequency with which a given instructional or learning strategy was employed within the teacher's classroom. For each treatment group (face-to-face and online), the mean score for each item was then calculated across all teachers during each administration period (pre-course and post-course). Recall that the scale was structured such that a low score (1) represented frequent use of the strategy while a high score (4) indicated that the student reported never being exposed to the strategy. Table 4 displays the change in mean response within each group. Within the face-to-face group, statistically significant changes occurred for three items. Specifically, students reported increases in the frequency with which teachers asked them to come up with new ways to solve math problems and to write in words about their approach to solving a problem. Students also felt more strongly that their teacher tried to understand the student's approach to doing math problems.

For the online group, statistically significant changes occurred for five items. Students of online teachers reported a decrease in the frequency with which teachers had them work on math worksheets, but increases in the asking students to come up with new ways to solve problems, explaining how they got answers to problems, and working on extended math projects. Students also felt more strongly that their teacher tried to understand the student's way of doing math problems.

To examine whether the amount of change differed between the two groups, an independent samples t-test was performed for each item. After adjusting for multiple comparisons, no significant differences among groups were found.

Table 4: Mean Score Difference between Pre- and Post-surveys by Treatment Groups

	Face-to-Face (n=35)				Online (n=45)			
	Pre	**Post**	**Change**	***p***	**Pre**	**Post**	**Change**	***p***
1. My teacher asks me to come up with new ways to solve math problems.	2.57	2.76	0.19*	0.02	2.66	2.87	0.20*	<0.01
2. My teacher asks me to explain how I got my answers to math problems.	3.28	3.38	0.11	0.08	3.30	3.39	0.09*	<0.01
3. My teacher tries to understand my way of doing math problems.	3.03	3.19	0.16*	0.02	3.13	3.21	0.08*	0.03
4. My teacher expects me to participate in class.	3.67	3.76	0.10	0.12	3.74	3.76	0.02	0.57
5. My teacher is interested in my work even if I get the wrong answer.	3.21	3.28	0.07	0.25	3.22	3.27	0.05	0.09
6. My teacher likes us to think about different ways to solve each math problem.	3.11	3.21	0.10	0.17	3.14	3.15	0.01	0.55
7. My teacher asks questions in math class that make me think.	3.28	3.22	-0.06	0.21	3.25	3.27	0.02	0.72
8. In math class, we work on math projects that last a long time.	2.00	1.90	-0.09	0.28	2.12	2.27	0.15*	0.02
9. My teacher reviews our math homework in class.	2.75	2.76	0.01	0.95	2.89	2.89	-0.01	0.39
10. My teacher helps me when s/he notices that I am having trouble in math.	3.38	3.33	-0.05	0.12	3.40	3.44	0.04	0.28
11. My teacher really listens to what I have to say in math class.	3.45	3.46	0.01	0.97	3.50	3.53	0.03	0.71
12. My teacher has us do math worksheets.	3.16	3.15	0.00	0.98	3.31	3.21	-0.10*	0.03

13. My teacher asks us to use drawings or pictures when we do a math problem.	2.49	2.66	0.17	0.08	2.63	2.63	0.00	0.55
14. My teacher asks us to write in words our thoughts about our answers to a math problem.	2.35	2.59	0.24*	0.04	2.78	2.77	-0.01	0.77
15. When I don't understand my math work, my teacher tries to help me by asking me questions.	3.13	3.07	-0.06	0.42	3.17	3.19	0.02	0.67
16. My math teacher really makes me think.	3.21	3.27	0.06	0.26	3.24	3.23	-0.01	0.53

* Change within group statistically significant at p=.05.

M. Mathematics Understanding

To examine the effect that participation in the online professional development course had on teachers' knowledge of teaching mathematics, teachers completed a mathematics test that contained 15 multiple-choice items and 5 open-response items. Table 5 displays the mean total score for each treatment group for the pre- and post-course test administration.

Within each group, total test scores increased significantly. For the face-to-face group, scores increased by 1.86 points (on a scale of 1-20) while scores for the online group increased 1.48 points. An independent samples t-test, however, indicated that the score increases did not differ significantly between the two groups (p = 0.48).

Table 5: Mean scores for Pre- and Post-Tests by Treatment Group

	Face-to-Face					Online				
	N	**Pre**	**Post**	**Change**	***p***	**N**	**Pre**	**Post**	**Change**	***p***
Total Score	36	13.57	15.43	1.86	0.02	49	13.68	15.16	1.48	0.02

VII. SUMMARY AND DISCUSSION

The study presented here compared the effects that a face-to-face and an online version of the same course had on the intended outcomes of that course. For both versions, participants engaged in the same reading material, learning activities, writing assignments, and instructional activities in their own classrooms. The length of the course was also the same across both conditions (8 weeks) and the level of participation and interaction among participants was designed to be equivalent. The fundamental difference between the two versions was the medium in which participants interacted with each other and their facilitator, namely face-to-face or online.

The intended learning outcomes of both courses were identical. Specifically, the course was intended to affect teachers' pedagogical beliefs, their instructional practices when teaching mathematics, and their understanding of teaching the base ten number system. To examine the effect that this online professional development course had on these three outcomes, several data collection instruments were administered. A mathematics test was used to measure changes in teachers understanding of teaching the base ten number system. A survey was used to measure teachers' pedagogical beliefs. And the combination of a teacher survey, student survey, and instructional logs were used to measure teachers' instructional practices.

As described in greater detail above, both conditions of the course altered teachers' beliefs about teaching mathematics, changed their instructional practices, and, to a lesser extent, increased their understanding of teaching the base ten number system. On average, there were significant increases in teachers' confidence teaching mathematics, strength in their belief in student-centered instructional practices, and confidence

analyzing students' problem solving strategies. As reflected in both the teacher's instructional logs and the student surveys, there were also several significant changes in teachers' instructional practices. Among these were asking students to develop new ways to solve math problems, trying to understand students' approaches to solving math problems, asking students to describe in writing how they solved math problems, having students work on extended math problems, and having students work in pairs or groups. Finally, a significant increase occurred on a test that measured teachers' understanding of teaching the base ten number system. Each of these outcomes is not surprising, particularly since teachers, on average, rated the quality of the course as high and reported that many components of the course provided valuable learning opportunities.

While a few differences in the magnitude of change were found between the two versions, overall the effects of the course were similar across the two conditions. Specifically, the improvement in teacher test scores did not differ significantly between the face-to-face and online versions. Similarly, there were no statistically significant differences in the amount of change in teachers' pedagogical beliefs. Among the twenty-seven instructional strategies teachers were asked to log, a significant difference was found for only one strategy—having students work independently. And, for the sixteen items on the student survey, there were no significant differences. Thus, overall the data suggests that, while both versions of the course affected the intended learning outcomes, the effects were similar across the two online and face-to-face versions of the course. This finding is consistent with previous research that generally reports similar effects for face-to-face and online professional development courses.

While the effects of the course were similar across delivery modes, it is interesting to note that there was a significant difference in opinions about whether, after completing the course, teachers preferred to participate in future professional development in face-to-face environment rather than online. While teachers who were in the face-to-face group expressed a strong desire for the face-to-face mode, those teachers who were actually able to experience an online version were less enthusiastic about taking future courses in a face-to-face mode. Since there were no differences in teachers' prior experiences taking online courses, this difference in opinion about taking future courses online or face-to-face may suggest that as teachers become more familiar with online professional development, they are more open to taking future courses online.

Nonetheless, these findings must be placed in the context of the many limitations of this study. First, the study focused on only one course delivered to elementary school mathematics teachers. Had a different course that focused on different types of teachers or different content been employed, the outcomes may have been different.

Second, both versions of the course experienced considerable attrition. On average, 36% of the teachers who began a course did not finish the course or the required data collection instruments. The fact that 36% of teachers did not complete the course may mean that the course either did not meet their needs or was too challenging for them. Although the characteristics of teachers who dropped out of the course did not differ between the two versions, it is plausible that had these teachers persisted, different findings may have resulted.

Third, the course employed for this study was well designed and employed high quality reading materials and learning activities. In addition, the course lasted for eight weeks. While the quality of the course was not compared to other professional development courses, it is likely that many other courses are of shorter duration, employ lower quality reading material, or ask participants to engage in less effective classroom activities. For a course that is shorter in length or that employs materials of a lower quality, the mode of

delivery may have a larger impact on the outcomes of the course.

Finally, all of the participants in this course were volunteers. Although a small stipend was offered to compensate participants for the time required to complete the data collection instruments, the teachers who participated and completed the course were likely highly motivated individuals who were sincerely interested in developing their mathematics teaching skills. In many cases, however, participation in professional development is required by a school or district. In such cases, some teachers may be less motivated or engaged in the learning. If presented with an online version of the course, some of these teachers might be unmotivated to log into the course, complete the reading and activities, or make a minimal effort when completing assignments. The resulting effects of the course might then be smaller.

Despite these limitations, this study provides further evidence that an online course designed as an interactive learning experience can have very positive effects on teachers knowledge, pedagogical beliefs, and instructional practices, and that the magnitude of these effects are similar to those that occur in a face-to-face environment.

VIII. ACKNOWLEDGEMENTS

The authors wish to thank their colleagues, Heidi Larson, Josephine Louie and Sherry Booth, for their contributions to this work. This material is based upon work supported by the National Science Foundation under Grant No. 0309401 to Author Organization. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

IX. REFERENCES

1. **Carey, R., G. Kleiman, M. Russell, J. D. Venable & J. Louie.** Online Courses for Math Teachers: Comparing Self-Paced and Facilitated Cohort Approaches. *Journal of Technology, Learning, and Assessment* 7(3): December 2008. Retrieved date from http://www.jtla.org.
2. **Russell, M., G. Kleiman, R. Carey & J. Douglas.** Comparing self-pace and cohort-based online courses for teachers. *Journal of Research on Technology in Education* 41(4): 361–384, 2009.
3. **Clark, R. E.** Reconsidering research on learning from media. *Review of Educational Research* 53: 45–459, 1983.
4. **Clark, R. E.** Media will never influence learning. *Educational Technology Research and Development* 42(2): 445–459, 1994.
5. **Bernard, R., P. Abrami, Y. Lou, E. Borokhovski, A. Wade, L. Wozney, P. Wallet, M. Fiset, & B. Huang.** How does distance education compare with classroom instruction?: A meta-analysis of the empirical literature. *Review of Educational Research* 74(3): 379–439, 2004.
6. **Cobb, T.** Cognitive efficiency: Toward a revised theory of media. *Educational Technology Research and Development* 45(4): 21–35, 1997.
7. **Kozma, R.** A reply: Media and methods. *Educational Technology Research and Development* 42: 11–14, 2004.
8. **Smith, P. L. & C. L. Dillon.** Comparing distance learning and classroom learning: Conceptual considerations. *American Journal of Distance Education* 13: 107–124, 1999.
9. **Garrison, D. R.** Cognitive presence for effective asynchronous online learning: The role of reflective inquiry, self-direction, and metacognition. In J. Bourne & J. Moored (Eds.), *Elements of Quality Online Education: Practice and Direction*, 47–58. Needham, MA: Sloan-C, 2003.

10. **Spicer, J.** Even better than face-to-face? In A. Thorson (Ed.), By your own design: A teacher's professional learning guide, 32–33. Columbus, OH: Eisenhower National Clearinghouse for Mathematics and Science Education, 2002.
11. Treacy, B., G. Kleiman & K. Peterson. Successful online professional development. *Leading & Learning with Technology* 30(1): 42–47, 2002.
12. **Weinberger, D.** Small pieces loosely joined. Cambridge, MA: Perseus Publishing, 2002.
13. **Delfino, M. & D. Persico.** Online or face-to-face? Experimenting with different techniques in teacher training. *Journal of Computer Assisted Learning* 23: 351–365, 2007.
14. **Meyer, K. A.** Face-to-face versus threaded discussions: the role of time and higher-order thinking. *Journal of Asynchronous Learning Networks* 7: 55–65, 2003.
15. **Sparks, D.** Dreaming all that we might realize. In A. Thorson (Ed.), By your own design: A teacher's professional learning guide, 18–23. Columbus, OH: Eisenhower National Clearinghouse for mathematics and Science Education, 2002.
16. **Lawless, K. & J. Pellegrino.** Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research* 77(4): 575–614, 2007.
17. **Ginsburg, A., T. Gray & D. Levin.** Online professional development for mathematics teachers: A strategic analysis. Washington D. C.: National Center for Technology Innovation, American Institutes for Research, 2004.
18. **Whitehouse, P. L., L. A. Breit, E. M. McCloskey, D. J. Ketelhut & C. Dede.** An overview of current findings from empirical research on online teacher professional development. In C. Dede (Ed.), Online professional development for teachers: Emerging models and methods, 13–29. Cambridge, MA: Harvard Education Press, 2006.
19. **Allen, M., E. Mabry, M. Mattrey, J. Bourhis, S. Titsworth & N. Burrell.** Evaluating the effectiveness of distance learning: A comparison using meta-analysis. *Journal of Communication* 54(3): 402–420, 2004.
20. **Neuhauser, C.** Learning style and effectiveness of online and face-to-face instruction. *The American Journal of Distance Education* 16(2): 99–113, 2002.
21. **Russel, T.** The no significant difference phenomenon. Montgomery, AL: International Distance Education Certification Center, 2001.
22. **Becker, H.** Internet use by teachers: Conditions of professional use and teacher-directed student use. Irvine, CA: Center for Research on Information Technology and Organizations, 1999. Retrieved December 10, 2008, from: http://www.crito.uci.edu/tlc/findings/internet-use/startpage.htm.
23. **Russell, M., L. O'Dwyer, D. Bebell & H. Miranda.** Technical Report for the USEIT Study. Chestnut Hill, MA: Technology and Assessment Study Collaborative, 2004. Retrieved December 10, 2008 from: http://www.intasc.org/PDF/useit_r11.pdf.

X. ABOUT THE AUTHORS

Michael Russell is an Associate Professor at Boston College's Lynch School of Education and Director of the Technology and Assessment Study Collaborative. Contact information: 332 Campion Hall, Boston College, Chestnut Hill, MA 02467, russelmh@bc.edu.

Rebecca Carey is a Project Director at the Education Development Center currently working for the Regional Education Laboratory for the Northeast and Islands. Contact information: EDC, 55 Chapel Street, Newton, MA 02458, 617-618-2892, rcarey@edc.org.

Glenn M. Kleiman is Executive Director of the Friday Institute for Educational Innovation and Professor of Educational Leadership and Policy Studies at the North Carolina State University College of Education. He was Vice President and Center Director at Education Development Center, Inc. (EDC) while the research

reported in this article was conducted. Contact information: 1890 Main Campus Drive, Raleigh NC 27606, 919-513-8509, glenn_kleiman@ncsu.edu.

Joanne Douglas Venable is a Research Associate at the Technology and Assessment Study Collaborative at Boston College. Contact information: 332 Campion Hall, Boston College, Chestnut Hill, MA 02467, jldouglas31@hotmail.com.

CROSSING CULTURES AND BORDERS IN INTERNATIONAL ONLINE DISTANCE HIGHER EDUCATION

Gulnara Sadykova
University at Albany

Jennie Dautermann
SUNY Center for Professional Development in Syracuse

ABSTRACT

The growing demand for higher education worldwide, along with global expansion of telecommunication technologies, give online distance education a potential world-wide reach for institutions in many countries. Given the persistent international digital divide and the potential for the host institutions and languages to be those of wealthy, industrialized countries, international online distance higher education (IODHE) has great potential for educational and cultural imperialism. Therefore institutions contemplating expansion into international distance education must accommodate a number of changes that would enable building the safe learning/teaching environment needed for development of a successful course. Drawing on literature of domestic and international online teaching and learning, multicultural studies, as well as personal international teaching and learning experience, the authors examine four domains where these changes are of critical importance: 1) host institution, 2) technology, 3) learning models of students, and 4) teaching models of faculty. The paper discusses issues and practices in each of these domains and offers general recommendations for institutions participating or planning to participate in cross-border/cross-culture online education.

KEYWORDS

Distance Education, Online Education, International Students, Higher Education, Culture, Cultural Differences, Institutional Policies, Educational Technology, Teachers' Beliefs, Students' Expectations.

I. INTRODUCTION

The growing demand for higher education worldwide, along with global expansion of telecommunication technologies, have given online distance education a potential world-wide reach for institutions in many countries [1, 2]. Those responsible for the financial health of institutions often look to emerging international markets as an opportunity for growth in spite of geographical or demographic limitations on their current enrollments. Consequently van der Wender reminds us that "The process of globalisation, characterized by increasing global economic interdependence and international competition, leads to the emergence of an international higher education market in which a growing number of traditional and new types of higher education providers compete with each other" [3, p.2].

Institutions contemplating expansion into international distance education must accommodate a number of changes. For example, policies initially designed to meet the needs of the "residential" university that present obstacles to distant online students, complexities of computer mediated instruction and technology mismatches, and perhaps most significant for the individual students and faculty, different

assumptions about teaching and learning that must be addressed in subtle and complex ways in the virtual international classroom are of critical importance. This paper explores some of these accommodations.

For our current purposes, we assume open courses that bring together students and faculty from a variety of cultures and geographical locations. We refer occasionally to partnership models that work between two or more specific cultures, but in general we are positing virtual classrooms where a common language is shared, although not with equal fluency, where students may represent a number of nationalities or cultures, and where the instructor may bring in yet another nationality or cultural heritage. We anticipate that such variety will eventually be the norm for international online distance higher education (hereafter referred to as IODHE) in the future, although many more limited experiments are underway at this time due to cross national partnerships, language issues, and differences in technology access [4].

Our reading for this paper has focused on the literature of international online teaching and learning as well as some collateral work on international students studying in residential settings and on the literature of multicultural teaching and learning. Our discussion is informed as well by our own international teaching and learning experiences and a belief that education and cultures are highly interdependent. We also believe that given the persistent international digital divide and the potential for host institutions and languages to be those of wealthy, industrialized countries, IDOHE has great potential for educational and cultural imperialism [5, 6]. Furthermore, the pressure of competition from for-profit schools may also contribute to a climate where there is more focus on building income than on nurturing students. Our discussion attempts to account for these complexities and to offer strategies for a more equitable vision of shared resources via the growing, though certainly not universal, access to the world wide web across the planet.

The diagram below lays out the four domains of IDOHE as a square in which each domain is shown to have connections to all the other three (Figure 1). The assumptions and functions of each of the four domains vary across cultures, across the previous educational experiences of students and faculty in a particular course, and across disciplines and types of institutions. We refer to these four dimensions as "discourses" because of the primacy of language (and other symbols) in making these domains visible in online environments, and because of the persistent need for negotiation to resolve inevitable conflicts within the temporary international community generated in any individual course. Each "discourse" in our diagram represents practices that may be culturally transparent to the host culture but which may seem particularly ethnocentric when viewed from an IDOHE perspective.

The illustration represents an individual IODHE course along with its supporting infrastructure. The inner square with its interconnected sides represents the discourses that inform and constrain the work of the students and instructor in that course. Besides its disciplinary content, any successful IDOHE course must be supported by a consistent effort across these domains as illustrated by the connecting lines. Thus IDOHE technologies must account for faculty and student needs, and be supported by an institutional discourse that acknowledges this relationship. We will first turn briefly to the assumptions and practices of institutions and technologies of concern to an IODHE course.

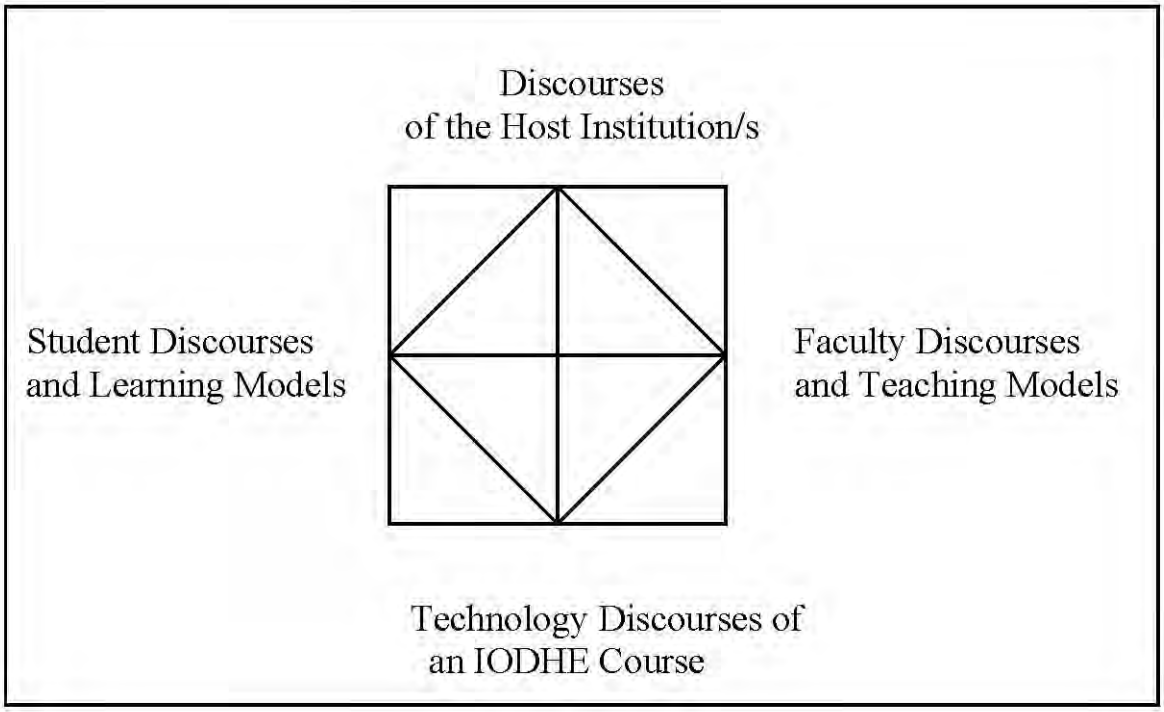


Figure 1. Discourse Domains of an IODHE Course

II. DISCOURSES OF THE HOST INSTITUTION/S

Putting institutional discourses at the top of our diagram acknowledges that institutional language and policies are a significant context in which IODHE is embedded. Darrup-Boychuk [7] and Sedgewick [8] remind us that individual institutions as well as national and provincial educational bodies and systems of accreditation have the power to foster IODHE and may have concrete economic or social reasons for doing so. Harley et al. [9] and Australia' Competitors [10] suggest that national governments with their control over immigration and trade also generate policies that may directly or inadvertently create barriers to IODHE planning and student recruitment. We acknowledge these issues as significant to the success of any individual IODHE effort, but for the purposes of this paper we shall confine our discussion to the institutional policies and practices of the host institution that directly affect IODHE work inside classrooms. Some of these practices derive from assumptions about the residential nature of an institution and lie deeply embedded in such mundane matters as student recruitment and enrollment, the academic calendar, requirements for earning credit, and preparation of faculty.

A. Institutional Issues for IODHE

Since the institutional impetus to build IODHE programs reflects, in many cases, a goal of increasing enrollment and income for the host institution, such projects tend to assume that the host institution has both the content and the delivery of knowledge in hand, and that with the addition of technological support, and perhaps some marketing and brand management, international online teaching projects only require minimum planning for instructional adaptations. Care must be taken to insure that such a colonialist model does not inform this planning, as Adam implies when he says, "Transnational education is the educational manifestation of this globalization process and strategies to adjust to it must fit with other national educational goals, e.g. to promote lifelong learning, transmit culture and increase competitiveness, etc" [11, p.49].

Certainly many institutions interested in IODHE have been hosting international students on their campuses for years without much adaptation of the courses to their presence. Often international student services, TA arrangements, and immigration questions are dealt with in offices of international studies where specialized staff members intercede with institutional policy matters with individual students.

When international instruction is moved into a virtual space, however, many student adjustment issues dealt with by international studies offices (visa applications, housing, adjustments to a new culture) become somewhat less urgent on campus. At the same time, adaptation of the actual classroom practices to the international online students' needs may be moved into other institutional offices where policies have not previously accounted for international students. Some institutional policies, for instance, assume that all enrolled students can visit campus offices to pay their bills, sign forms, be advised, sit for ID pictures, and more. And while a few campuses are well on the way to moving student services for registration, paying fees, and advising into virtual spaces, many other schools do not make this shift a priority even though they are actively promoting online distance enrollments. This mismatch may not be evident in initial online projects for commuting students who live reasonably close to campus, but in the process of offering a course to a worldwide audience, these policies may bring certain issues into greater prominence. Since such policies sit in a quite different institutional location from traditional international student services, accommodation to IODHE may require an institutional commitment that extends well beyond the distance education office. Robert Knipe claims that policies designed for residential students are a significant factor inhibiting the growth of online programs at his own institution [12]. He cites examples in which his online students have been unable to register, pay tuition bills, secure library privileges and meet specific graduation requirements because of policies that require them to be physically present on campus.

Other campus policies may not require students to be on campus, but may make it difficult for a course to be offered online in parallel with similar courses offered on the campus. Prerequisites, random assignment of students to multi-section courses, and attendance policies designed for residential settings may interfere with the offering of specific courses online. Scheduling of IODHE courses can be incompatible with the host institution's rules about drop/adds, or number of contact hours, or efforts at modest synchronous activity across world-wide time zones. Even catalog labeling of online sections becomes significant for IODHE students, and may be subject to elaborate institutional approval processes.

Policies that are applied to all students on a campus regardless of full time or part time status can also present difficulties to distant online students. The State of New York, for instance, has a requirement that any student in its universities and colleges must show proof of immunization against certain diseases particularly prevalent in college age populations. Other systems have mandatory health insurance fees for students who register. Program directors in New York were able to get the immunization requirement waived only for students who *never* set foot on the campus under any circumstances. The institutional discourse of a residential campus that underlies many of these examples may depend on long held assumptions about campus life and may require careful negotiation of traditional institutional practices.

Finally, marketing and recruiting students can look quite different in an international setting when compared with an institution's local efforts. New legal issues are likely to arise for IODHE courses: legitimacy of certain fees, negotiations with international sites for proctored exams, and developing of partnerships for distant support for hybrid efforts or laboratory experience are added to the institution's responsibilities. Indeed Sedgwick [13] predicts that this need for services may introduce a significant amount of risk for IODHE students who must depend on an institution's public discourse to determine whether there are adequate resources for them on a particular campus. See also [2].

B. Institutional Practices that Open Up Spaces for IODHE Courses

Some traditional institutions have addressed IDOHE issues described above by moving online instruction into some non-traditional space for campus services such as continuing education where students can be served by different policies than those designed for residential students. This move illustrates the first stages of a mindset change that is required for an institution that would open its "residential" campus doors to students who represent neither residential nor commuting student groups. This mindset change would involve thinking of the campus as a much more open (even global) physical space. Other strategies for opening up an institution's campus come in many forms, some of which seem to be small steps on the way to something more global.

1. Choosing an Appropriate Program Design and Delivery Model

One way to reduce the complexity of international online distance education is to limit program design and delivery models. Several studies have discussed institutional partnerships where only two institutions and fewer language groups are represented. This strategy serves to reduce the scope of the multicultural mix in early efforts [14, 15].

Hybrid courses that combine face to face meetings with online work, often useful with working or disabled students [16, 17, 18]) can sometimes be replicated with middle-ground IODHE strategies that mix online with face to face instruction in different ways. Tutors and satellite classrooms can sometimes be offered at some distance from the campus centers and connected by lectures broadcast over great distances [19]. Wiesenberg & Stacey recommend blended pedagogies that combine more traditional didactic methods with collaborative strategies [20]. We expect mixed-mode programs where students live one year in the host country taking residential classes and then complete their degree studying from home online to emerge eventually.

Labour and his colleagues [21] point to courses that are taught in multi-lingual modes, and Branden & Lambert [22] also argue for a multilingual approach. Other solutions involve offering options in the length of the course to accommodate different calendars. Washington State University, for instance, offers flexible enrollment courses where students can take an additional semester to complete course work for a $100 fee [23].

2. Matching the Course to the Student

Educational institutions need to share the responsibility of matching course expectations and requirements to student's needs and abilities. Bentley, Tinney & Chia [5] suggest that institutions prepare for IODHE projects by looking carefully at course catalogs, and registration and recruitment materials. Early information about course requirements, learning resources and expected outcomes are seen by Troy State University, Montgomery as essential for students to make wise choices [24]. Washington State University accompanies some course syllabuses with RealPlayer videos introducing the instructor and describing the course objectives [25].

At Western Governors University new online students complete a skill survey and are assigned mentors who conduct extended phone interviews for academic planning [26]. Proactive academic advising is also offered at Saint Joseph's College of Maine, where advisors keep regular contact with prospective distance students via phone, mail, and email [27].

3. Academic Support

Ongoing 24/7 academic support remains a dream for many active distance students. Still some institutions establish support systems that are accessible throughout most of the week. Mentors at Western Governors University are reported to provide feedback within 24-48 hours; besides electronic communication, they make themselves available for phone appointments [26].

Electronic communication with peer mentors is often attractive for IODHE students. Distance students at Berkeley College and Mercy College have already had a chance to see advantages of faculty and peer tutors in all subject areas including specific writing for papers or essays. Mercy College students feel more at ease with assistance from other students or online "wizards" who serve as tutors, facilitators and role models [28]. To improve foreign language speakers' academic writing skills, Capella University offers a course Graduate Writing for ESL/EFL Learners [29].

Some educational institutions offer preparation courses and custom tutorials to help new students fill knowledge gaps. Berkeley College, Stanford, SUNY Empire State College, and the U.S. military have all developed self-tests or preparation courses for online students [30, 31, 32].

4. Preparing Faculty

Professional development courses with emphasis on cross-cultural issues is essential for faculty who participate in IODHE. Maryland Online's highly regarded online training for new faculty offers learning modules related to the design and management of online courses [33]. At Florida Community College at Jacksonville new adjunct online faculty are assigned virtual mentors who advise on pedagogical, logistic and technology matters [34]. Comprehensive faculty support provided by the State University of New York's SUNY Learning Network (SLN) assists both new and returning faculty in designing, facilitating, evaluating and re-designing online courses [35].

Labour, Juwah, White, & Tolley [21] describe an online workshop originally developed under the Online Tutoring Skill Project to prepare staff in Scottish higher education institutions. The workshop agenda addresses many challenges an online instructor may encounter in a multicultural classroom and provides suggestions to help avoid cultural misunderstanding in an online learning environment. Training 'global' e-teachers, knowledgeable in pedagogies and prepared to work with IODHE students, should become an imperative for institutions marketing their online programs to international audience [20, 36].

All of the strategies described here open the "residential" features of an institution and make significant progress toward a more global campus—one that is well on its way to accommodating IODHE coursework.

III. TECHNOLOGY DISCOURSES FOR AN IODHE COURSE

Technology replaces the brick and mortar infrastructure of a university's face-to-face curriculum and enables that curriculum to be replicated, adapted, challenged, or even re-invented for IODHE purposes. While providing access to quality education to IODHE students and mediating their course communication, technology adds a different sort of openness to a campus. But care must be taken to make sure that the virtual spaces are welcoming to IODHE students. Decisions made in this domain may determine whether persons from certain national, ethnic or economic groups can even participate in IODHE at all [37], but in addition to software, hardware and broadband questions, the work of Bruce King [38] emphasizes significant questions about how specific technology practices may support or complicate the delivery of instructional content.

A. Technology Issues for IODHE

Students connecting across borders and cultures are quite vulnerable to the disparity in technology availability in different parts of the world. According to the Internet World Stats [39], the number of Internet users around the globe differs drastically: in North America almost 70% of population uses the Internet, but there are only 3.6% of Africans, 10.7% of Asians and 10% of Middle Easterners who have such a privilege. Even Europe reaches only 38.9%. Considering such statistics, there exists a high probability for mismatches in technology access and skills among students coming from different countries/cultures.

Belz [14], for example, reports on a US-German telecollaboration where differences in technological access and know-how caused unequal participation of two cultural groups. Liaw [15] observed that technological difficulties, such as system break-downs, exacerbated other complexities associated with cross-border/cross-culture communication. Howell et al. [19] describe a course in sub-Saharan Africa in which video, audio, and chats were attempted in the absence of adequate broadband support for the students. In all these cases, the differences in technology use and access created considerable frustration for everyone involved.

Software commonly used in the U.S. and some other countries such as Microsoft Power Point or PDF may not be available to students in less technologically developed countries. Nor should IODHE course developers automatically assume that students have broadband Internet connections or that the traffic is unlimited and cheap. Even downloading a text file in one of the latest additions of Microsoft Word could be problematic for some IODHE students. So providing files in alternate formats, e.g., converting latest version files to RTF or text-only can be crucial. Course developers can also reduce file sizes of images and audio/video materials, and provide good options for free or inexpensive software.

Cross-cultural complexities related to technology also exist on some quite subtle levels. A number of studies suggest that cultural background may influence the way users respond to web content and design features. Wurtz [40] found that websites developed for Japan, China and Korea made images more prominent thus providing an elaborate communication alternative to the text. In contrast, websites in Germany, Denmark, Finland used less animation and a more linear navigation. Evers [41] reported that subjects from English-speaking countries derived most of their understanding of the website from text rather than graphics, while Japanese students were more influenced by the graphics. Cultural variability was also prominent in studies by Marcus & Gould [42] and Faiola & Matei [43] who showed that web content is processed faster when created by designers from the user's culture. These preferences are significant for IODHE because web design features affect usability of web content and may increase or decrease the ability of students to access course content efficiently.

Composing and typing in chat environments offer little time to refer to dictionaries or to carefully formulate ideas [44]. Chinese students interviewed by Thomson & Ku [45] found chat communication unpleasant and disorganized. Though synchronous chats are sometimes recommended as a community building tools (see, for example, [46]}, IODHE course developers should beware of the pressure they can add to a student's participation. Dorazio, Hickok & Thornton [47] report on an American-German project, where international teams were able to choose among a range of communicational technologies. They observed students using bulletin boards and online chats for communication and video podcasts for team camaraderie. Blogging, however, did not allow team members to have ongoing conversation threads and to group similar topics and made the German students uncomfortable about their command of English.

Most online courses use an asynchronous written mode of communication, which has fewer visual and oral cues and makes conversations somewhat less personal. Warschauer [48] found that electronic discussions had fewer interactive features such as questioning, recasting, confirmation checks, and paraphrasing that are common in face-to-face interaction. Thus online conversations may loose coherence and immediacy, and may result in disengagement and lack of engaged interaction [49, 50]. Ware's study of telecollaboration between university students from Germany and the US revealed that though both groups of students posted frequently, they rarely engaged in interpersonal interaction (as indicated by response to direct questions, use of second-person pronouns, elaboration, etc) [49].

B. Technology Practices that Offer Useful Virtual Spaces for IODHE Courses

1. The Basics

Course developers are sometimes limited in their selection of learning management software because of the host institution's commitment to specific products. Many IODHE projects use open source software to supplement or replace a standard course management system. Dalsgaard [51] argues for using "educational social software", such as weblogs, wikis, RSS feeds, and social bookmarking, as alternatives that support a socially constructed e-learning and self-directed learning activities. These tools can also render the learning environment more sensitive to cultural and individual differences among learners.

No matter what technologies are employed, each IODHE course needs to be equipped with a "technology roadmap" that informs students of minimum hardware and software requirements *prior* to registration. This roadmap would also provide links to inexpensive downloadable programs and tutorials for those unfamiliar with the tools. Rochester Institute of Technology offers such a roadmap on customized course webpages [52]. The Online Student Orientation site at Old Dominion University also serves as a gateway to online courses and provides students with online tools to assess and upgrade their computer proficiency [53].

2. Providing Technical Help

In anticipation of technology mismatches across distance, course facilitators must consider how students will resolve technical difficulties. Having a help desk that answers questions by phone on a schedule tied to a local time zone and the host culture's holidays can limit IODHE student options for helpdesk service. Having a support team accessible 24/7 via telecommunication (both real-time and delayed) would be more desirable. Course developers and facilitators may also need to provide additional scaffolding related to technology skills. If a course assignment involves creation of electronic documents, instructors may need to provide alternative forms of knowledge/skills demonstration or offer technology tutorials for self-study. An excellent Student/Faculty HelpDesk system is a primary supplement to Pennsylvania State University's World Campus. HelpDesk technicians, accessible via email, real-time chat, or phone, are able to resolve 90% of reported problems within 15 minutes [54].

3. Virtual (Computer-mediated) Discussions

Electronic discussions, so popular among online educators in the U.S., should be adapted for IODHE so that they use the very simplest technology possible. Synchronous (real-time) modes of electronic communication need to account for worldwide time zones and allow for additional time for speakers with less fluency in the host campus language. Online chat systems can reduce response time to a minimum, but offer few visual oral cues to support understanding, and can increase anxiety. Some current technologies are emerging to take better advantage of synchronous exchanges and to incorporate oral messages and video, so the technology vocabulary of IODHE courses may eventually be able to counter

these effects if there is adequate bandwidth on both sides of the distance.

And of course, some researchers have found computer-mediated communication to increase participation of students whose gender, cultural background, low self-assessment of language fluency or low status in groups hinder equal contribution to discussion in face-to-face formats [55]. Morse [56] reported that the ability to freely express their thoughts was rated the number one advantage of computer-mediated seminar discussion by non-native English speakers, and online students from China, interviewed by Thomson & Ku [45], also felt more inclined to participate in electronic discussions. Thus cultural responses to technological decisions and practices must be accounted for by IODHE planners in ways that relate both to bandwidth and hardware as well as to teaching and learning choices.

IV. STUDENT AND FACULTY DISCOURSES AND LEARNING MODELS

The opposite sides of our diagram (see Figure 1) represent the necessary dialogue between teaching and learning in IODHE coursework. The right side of the square represents both the students' various cultures as well as each individual's particular learning preferences. In the courses we describe here, there are likely to be cross cultural issues among the students. Thus the students must find ways to negotiate ways to comprehend their peers' responses to the course material in ways a mono-cultural classroom might not force them to explore. When IODHE students encounter dissimilar cultural assumptions about school or about how languages work, or how students ought to behave in school, these cultural distinctions need to become part of the course content and be perceived as acceptable and useful there.

Student discourse reflects students' educational values which are believed to be "shaped by (a) cultural norms, (b) the philosophy of learning to which we adhere, and (c) our personal preferences for learning" [5, p.117]. Previous educational experience influences an individual's expectations for a course and informs their learning strategies, communicational patterns, and beliefs about appropriate and fair assessment. Taken together, these factors can have a significant affect on a student's academic performance.

On the left side of figure 1, Faculty Discourses and Teaching Models drive the individual IODHE course via the selection and arrangement of course content and the enactment of the central educational model for the course. Just as students bring cultural "baggage" to the virtual environment, faculty do as well. We placed student and faculty domains opposite each other in the diagram to illustrate their reciprocal nature. Because of this interdependence, faculty and student IODHE discourses often cluster around similar issues that we will discuss in terms of their relationship to one another.

A. IDOHE Student Discourses And Learning Models; Issues

It is predicted that by 2025 there will be four times more prospective students interested in receiving higher education from non-local (out-of-native-country) educational institutions, and 70 percent of them will be Asians [57]. Though this prediction concerns all potential international students, one may expect that considerable number of these students will opt for online mode of education. Who are these international online students**?**

1. Demographics

In the U.S., online students are mostly fully employed professionals over 25 yeas old [2, 58] and they

choose online programs as the most convenient way of obtaining education while balancing their professional and family responsibilities [56]. However, we should not assume that potential online students in other countries also fit this demographic group. In fact, undergraduate students from major cities working on their first degree are the most likely IODHE population in Asian-Pacific region [2]. This demographic may also be primary for other regions where online cross-border education may fill the niche left vacant by local educational institutions. Patton [59] further points out that distance education programs could attract international students who have to return home due to financial pressures—generally students with lower socio-economic status. Thus, demographic characteristics of students coming from different countries may differ on such dimensions as age, previous educational experience, motivation to study, and socio-economic status.

2. Language Issues

Since the U.S.A., Britain and Australia/New Zealand are three top leading producers of online education, many of the online courses discussed in the literature are monolingual with English being the dominant language. International online students are expected to bring to the course an adequate knowledge of English. However even when a satisfactory score on TOEFL (Test of English as a Foreign Language) is required to register for a course, many international students are unable to achieve parity in discussions and other written assignments with speakers whose first language is English. International students are also at risk of misinterpreting postings and assignments or of being misinterpreted by others thanks to misused vocabulary or grammar structures. There is also great potential for misreading communicative strategies such as turn taking, criticizing, apologizing, recasting, switching registers, and more. Idiomatic expressions, colloquialisms, regional or professional slang, references to local pop culture may also confuse second/foreign language speakers [81]. The intimidating nature of the process of written communication was well articulated by a Chinese student interviewed by Thomson & Ku [45]:

> I need to look words up in the dictionary occasionally. Sometimes I wonder what the teacher is going to think of my writing. They might think it's too simplistic. I don't know whether they will use this simplicity to judge my writing or not.

The academic discourse of English speaking countries could also be an unfamiliar ground for many international students. The generally accepted theory of "contrastive rhetorics" pointed out by Kaplan [82] assumes that written discourse is structured and further interpreted in accordance with cultural thinking patterns embedded within a unique language system. In the online mode of education, where written discourse prevails and opportunities for negotiation of meaning can be limited, language background can complicate a students' performance in significant ways. Krampetz' study [83], which observed patterns of codes and code-switching among international students studying in a U.S. university, showed that international students struggle when trying to conform to requirements of formal academic writing and have to adjust their native ways of thinking, writing and "making meaning" to the U.S. models.

3. Learning Styles: Cultural and Individual

It is important for a discussion like this to avoid the black-and-white worldviews embedded in the scholarship that tends to create a bipolar view of cultural differences by constructing the east-west or north-south divides per the work of Edward Hall [60, 61] and Geert Hofstede [62, 63, 64]. In much of this work Western students are generally portrayed as verbal/analytic learners who are ready to critically analyze ideas, voice their own opinion, and challenge instructor' or peer's point of view, while Asian students are considered visual/holistic learners who perceive presented content and ideas as unquestionable and instructor's status indisputable and absolute [44, 45, 65, 66]. Cultural background is

often made responsible for variations in learning styles observed from culture to culture (see, for example, [5, 67]). Asians are usually perceived as good test-takers, rote-learners and those who learn by observing and doing [16, 36, 45]; Europeans seem to prefer a self-discovery approach, whereas Americans are often taught using tell-and-test training materials [68].

Recent work by Agar [69] questions most generalizations about culture and suggests that intersections between individuals must account for the standpoint of individuals on either side of an encounter and that the concept of culture consists primarily of relationships rather than descriptive characteristics. An online course of the form we discuss here brings together 20-30 individuals that may not necessarily exhibit the typical (or stereotypical) behavior of their parent cultures. In fact some recent studies show that students coming from different cultural backgrounds may exhibit similar behavior patterns (see, for example, [70]), or conduct themselves in ways that do not align well with the assumed models of behavior for their national or ethnic heritage [71]. Nationally-driven constructs such as Hall's and Hofstede's may not meet "the challenge of dealing with cultural generalizations: in a nutshell, how to learn from the experience without falling into valueless stereotypes" [72, p.2]. Attention to personal idiolects and the regional dialects of individuals in an IODHE course might be a more productive and fair way of studying multicultural online communities. "As anything other than a generalized derivative, the individual disappears in an approach that uses the nation as a determinant of culture and thus of online behavior" [71]. But those individuals bring an OIDHE course both wealth and challenge as we shall discuss below.

B. Faculty Discourses and Teaching Models: Issues

Just as student discourses reflect students' educational values, faculty discourses manifest educational values of a faculty member's home culture and affect her or his philosophy of teaching and individual teaching style. The *I-teach-how-I-was-taught* model can be altered and modified with time and experience, but embedded cultural frames [73] determine the direction of these modifications and constrain faculty beliefs about what good teaching is. An Asian professor interviewed by Pan et al. [44, p. 328] recalls:

We were taught all the Confucian values. Like, we should respect our teacher. We should be humble. We should not speak too much. Just listen, don't talk too much. And don't try to raise too many questions.
The teaching models generally practiced in educational institutions that host IODHE programs must be flexible enough to address a great variety of students and faculty – including this Asian professor.

1. Online Instructor Demographics

Just as an institution may assume that their current curriculum can be converted to online instruction with relative ease, the identity and role of online faculty is often assumed rather than discussed. The literature is full of discussions of what students are like and what they may be apt to respond to in terms of teaching techniques and online pedagogies, but the diversity, attitudes and experience required of online instructors is unexplored in many discussions. The ubiquitous "online instructor" referred to in many studies however, may be a faculty member of any rank, an adjunct or lecturer, or in some cases a representative of a commercial firm contracted to produce and execute an online program. This outsourcing trend seems more likely if the online effort has been moved into marginal space in the institution such as continuing education, workforce instruction, or a specific online education unit.

Faculty often come to online teaching as self-selected early adopters and are most often fine teachers whose intellectual curiosity leads them to devote much time and energy to their projects. Adjuncts and part time instructors, a growing segment of many higher education systems, often see online instruction as a way to augment other jobs, to extend their qualifications for full time faulty status, or as a way to earn benefits ranging from tuition breaks to health insurance for their families. As with online students, there is

considerable interest in the 24-7 and geographical convenience of online instruction. Given the reduction of distance through online coursework, instructors can be geographically as widely dispersed as the students are.

So if we presume students from all over the world in an IODHE course, we can also assume that the instructors can also be from all over the educational world. Of course, many institutions assume that their online efforts will be staffed by their current face to face faculty, but the commercial online education firms already recruit instructors from well beyond their immediate community and some of the oldest university-based online projects recruit for their programs worldwide (see especially Maryland, Penn State, and New Zealand Polytechnic). All this is to say that there's clearly not a "typical" online instructor or faculty member any more than there's a "typical" online student. So, what we say here must account for great variety in faculty discourse and teaching models unless an institution makes a concerted effort to align online teaching practices in the courses they offer. A primary issue, however, that informs much current faculty training for online instruction relates to teaching models that emphasize learner involvement and assume a teaching model in which the instructor's presence in the course is significant.

2. Learner Involvement and Constructivism

In the U.S., current online teaching theories tend to address not so much individual cognition but rather a context where students engage in "an act of enculturation… in mediated social context" [74]. This approach resists teacher-directed models of instruction in favor of learner-centered principles where the learner is given more responsibilities over the process of learning, and where she/he is encouraged to speak up, ask questions, doubt existing opinions and act as a co-constructor of knowledge along with her/his peers and the instructor. Moreover, numerous research studies conducted by U.S. scholars argue that learning effectiveness increases with frequent and quality interaction among and between online students and instructors (see short literature review by Swan [75]). Research by Jiang and Ting [76], for example, suggests that online instructors should place a considerable value on frequency and quality of postings in online discussions to promote student learning.

Thus most online courses that we are aware of make extensive use of threaded discussions and "conversation" tools embedded in modern learning management systems, such as Blackboard/WebCT, ANGEL or Moodle. In our experience 'quality' postings generally assume that students critically reflect on readings and postings of the instructor and peers, independently or in teams, find evidence in support of their own ideas, and express their thoughts in accordance with rules of formal academic writing.
Other constructivist strategies that appear in online courses involve project-based learning, interactive assignments, individual and group presentations, learning portfolios and the like. Such student-centered activities are also open-ended so as to encourage individual creativity and inspire good teamwork skills.
Students from cultures outside the U.S. may experience significant difficulties when placed in learning environment like these, so IODHE instructors may need to revise their instructional approaches when dealing with a course filled with students who may have learned primarily in teacher/test driven educational systems, or in European orals systems, or the Cambridge system with its weekly writing tutorials, or even in one-on-one tutorial environments. With such potential variety in the teaching histories present in an IODHE course, the importance of matching teacher discourses with student discourses should not be underestimated.

3. Disciplinary Expectations

Besides pedagogical philosophies and nationally accepted educational systems, a faculty member's own educational values may vary with his/her discipline. Becher [77] compared different academic disciplines to tribes that have their distinct cultures, while Bauer [78] showed that disciplines have different methods of generating knowledge, based on quite different epistemologies as well as specific teaching/learning

preferences [79]. Moreover, research suggests that some faculty may doubt that their academic discipline is conducive to distance delivery [80]. These attitudes certainly influence the way such individuals approach online instruction.

4. Faculty Preparation

Some faculty may lack knowledge of how online technologies can be used in service of an academic discipline, but they may also have limited knowledge of pedagogy in general. Professionalization of pre-service faculty in the cultures we know is still in its infancy. Doctoral programs across different disciplines may not train future university faculty in teaching at all; more often, university scholars are skilled in research methodologies and academic writing as practiced by their academic disciplines. Schools of Education train K-12 schoolteachers and rarely offer anything for future university professors. As a result, faculty members may lack pedagogical skills and reach out to their own experience as students for their only models of what instruction should be like. Years of teaching experience do help (though not for everyone) but in the complex context of cross-cultural online education, an IODHE student can be at much greater risk of failure with an underprepared instructor.

Thus, culturally loaded educational values, closely interwoven with individual preferences in learning, influence both faculty and student discourses in our diagram and require consideration when designing and facilitating an online course.

As this short description shows, IODHE students and faculty may have conflicting educational values. Cross-cultural literature touches these issues but it seems rarely anything is being done to accommodate needs of international students coming from diverse educational systems [84]. In online contexts, learning activities need to be matched to the particular students in a course not just the stereotypes of pseudo-multiculturalism where nods to the global “norms” of national cultures are made topics of class discussions.

C. Creating A Third Cultural Space for Learning and Teaching in IODHE Courses

While institutional and technology strategies address IODHE issues on global level (unless, of course, the course has a self-paced automated structure) the quality of cross/inter-cultural experience one receives in a particular course depends on the work done by the instructor and the student inside the virtual classroom. We believe that this work requires imagining and building a safe ‘third space’ where students and instructor alike negotiate a new classroom environment where cultural assumptions about learning and teaching brought to the course can be honored, but where for the duration of the course, a new contingent cultural space is derived from the needs of everyone present [85]. Bretag [86] defines the third space as “a concept used to describe the possibility for a negotiated re-imagining of cultural identity [achieved by] constructing and re-constructing of identity, to the fluidity of space, to the space where identity is not fixed... [It] is where we negotiate identity and become neither this nor that but our own”. Bretag applied the concept of third space to teacher-student interaction and explored ways of changing hierarchical relationship between these “two very distinct 'cultural identities' predicated on unequal power relations within academia” [86].

We believe that all four domains in our diagram are responsible for building the safe learning/teaching environment needed for development of a successful IODHE course. But once certain conditions are set by the institution and the technologists, students and instructors must generate their own cultural space inside the virtual classroom; a successful third space effort primarily requires students and faculty to suspend some commitment to their previous schooling experience and look for new ways to relate to each other in this unfamiliar territory.

A third space online classroom requires an environment of trust, respect and acknowledgement of multiple voices, appreciation of student goals, and faculty flexibility and reliability. In such a classroom, cultural and individual differences are not only acknowledged but also become a matter of exploration and pride. Differing cultures need to be provided with "mutual safe harbor" [44] where one culture does not dominate, and where those from underrepresented groups do not feel deficient. Students and teachers alike look for ways to avoid seeing cultural differences as 'deficits' and to discourage universalized meta-narratives [6]. Negotiating the third space entails listening and giving all others the opportunity for self-expression as well as a commitment from all parties to grasp this opportunity for generating new perspectives [87]. In the sections below, we'll explore the way a third space might function in an IODHE course--particularly in the areas of course content and course management.

1. Course Content in a Third Space Course

Teaching for an IODHE audience in a third space mode quite likely will require re-thinking and re-working the course content to make it relevant and comprehendible to students who do not share a common cultural heritage. The adjustment of the course content could necessitate the changes in the choice of texts, assignments, content language, and teacher expectations of how texts are interpreted and assignments are done. It also asks for reconsidering how new content is addressed.

a. Diversification of Content Sources

Culturally sensitive content would include cultural narratives and examples from international sources that represent the heritages of students in the course, but also represent international perspectives that might not be present. Textbooks from international authors, as well as collections of articles published worldwide, can be used to diversify content sources and illustrate ways to account for multiple perspectives. Non-textual content (images, sounds, and video) can be selected to avoid cultural bias and show appreciation of diverse cultural background of learners. Student examples and contributions to the course content would be essential for countering the tendency of the instructor's experience to become the "norm" for the course.

b. Course Sssignments

In a third space course, assignments and activities welcome expression of cultural identity and avoid one-sided visions of the world. Efforts are made to create assignments appropriate for culturally diverse audience, similar to those found on the Rensselaer Polytechnic Institute (NY) website [88]. This collection of culturally-situated design tools illustrates how examples from non-dominant cultures can be used to teach mathematical concepts. One of these learning tools explains the concept of ratio though Latino-Caribbean music and allows the learner to simulate traditional musical rhythms; another describes and illustrates transformational geometry and iteration using cornrow hairstyles traditional in African cultures. Designing such learning tools helped RPI students develop their programming and teaching skills at the same time it offered them a safe space to express their own cultural identity and learn respect for the customs of others.

Another good source for inspiration of culturally-sensitive activities is *Wilderdom* [89] This site explores the cultural bias in I.Q. tests, offers tests designed for cultural minorities (African-Americans, in this case), and provides discussion questions for promoting cultural pluralism. If such websites were more popular among online instructors, one of the authors of the present article could have avoided the frustration and resistance she experienced in an online ice-breaker activity which invited students to solve a set of visual puzzles entitled "I.Q. Test". Being a foreign language speaker unaccustomed to such puzzles, she felt this incident distanced her from the emerging online community, and diminished her self-confidence in the course.

c. Accessibility of Textbooks, Lectures, and Other Required Materials

In IODHE, all materials related to the content of the course must be easily accessible worldwide. Amazon and other online stores popular in the USA do not deliver textbooks to all locations, and even when they do, the costs and shipping delays can be excessive. However, many online programs continue to require printed textbooks and place the responsibility for obtaining these books on students themselves (see, for example, [90]). A third space perspective reminds instructors to use primarily electronic content that can be accessible by everyone. University of Phoenix Online, for example, posts all lectures, questions and assignments online in text format which students can review off-line [91]. Keeping in mind the geographical spread of IODHE students, a third space IODHE instructor remembers to post detailed lectures online and provides electronic versions of additional readings selected to be copyright neutral. Moreover, now that many publishing houses have started offering books in digital formats, selecting electronic textbooks or publishing one's own electronic books can serve the varied needs of IODHE students.

Reusable digital learning objects may also be helpful. The MERLOT consortium [92] has assembled a large collection of peer-reviewed online learning objects coming from multicultural and multilingual sources and offers digital materials for both humanities and hard sciences. Indiana University-Bloomington has created its own set of multimedia learning objects that can be redesigned and implemented in different online courses with little training and cost [93].

d. Laboratory Work

As many undergraduate and associate degrees students are required to take laboratory courses, lab partnerships can be arranged to serve third space goals of building trust and tolerance of others' views. Institutions and faculty look for ways to recreate laboratory experience either online or at home and shared among student teams. The University of Virginia has created a Virtual Science Lab which enables students of microelectronics to "climb inside objects, to see fields and forces, or to zoom in on things as tiny as atoms or electrons" from home [94]. Vanderbilt University has successfully experimented with off-the-shelf electronic laboratory simulation software [95], which eliminated the need to travel to physical laboratory settings. The Department of Biology at West Chester University has designed software for biology experiments [96]. Distance students of two chemistry professors at University of North Carolina, Wilmington and University of Colorado, Denver have turned students' home kitchens into chemistry labs [97]. Online courses offered at Minneapolis College of Art and Design re-recreate a studio-based model online [98].These projects and others illustrate ways that virtual and home labs and studios can allow online students to avoid trips to physical laboratories, but an IODHE third space instructor would take care that the "kitchens" being described and employed for such work were appropriate to the student cultures represented in the course..

e. Using Local and Virtual Libraries

Diversification of content sources can sometimes allow students to gain access to materials through local libraries. Additional learning materials required to complete assignments must be assessable on the WWW or via online libraries that provide direct access to its digital resources and offer free services in digitizing printed materials. Although many U.S. university libraries have started offering such services, apparently some of them have yet to recognize the need to minimize the size of digitized articles: one library, for example, delivers materials in PDF format where one article can exceeds 1 MB and overwhelm a dial-up connection. A third space instructor learns whether this is a problem for her/his students and finds ways to work around such issues.

Some online libraries provide services in languages other than English. Long Beach City College library,

for instance, assists its Spanish-speaking student population with information on their first language [99]. While such practices generally target Latino immigrants residing in the USA, library services in native languages of target international audience would be similarly helpful for the successful generation of a third space in IODHE courses.

Online interactive library services are currently available 24/7 to all patrons of libraries united through commercial reference management service software [100]. *Maryland AskUsNow* provides live online interactive services to Maryland students and residents belonging to over 30 university and public libraries [101]. While the chat format of such services could be problematic for some IODHE students, email reference services of highly qualified librarians could be of great help to many international distance learners.

f. Language Issues

As described above, IODHE learners may experience significant difficulties in a learning environment which 'speaks' a foreign language. Thus a third space course will find ways to use student languages wherever possible, and give special attention to the language used to describe concepts and communicate with international students. Researchers recommend avoiding complex syntax and idiomatic expressions, local humor, local insider examples, and culturally-bound allusions to ensure cultural neutrality and portability for a course and to minimize drop-out rates [5, 21, 81, 102].

Ideally, a third space IODHE course might operate in a multilingual mode with multilingual instructors, but more feasible solutions might include provision for using texts in other languages, translations and team teaching. This can be arranged by involvement of multilingual international graduate students, cooperation with foreign/second language instructors, and using transnational tandem teaching with involvement of local (international) educational institutions such as that reported in Howell et al. [19].

g. Faculty/Student Expectations

IODHE instructors and students alike must re-evaluate the process of content acquisition. Humanities courses with considerable interpretive variety (history, art, literature, for instance) need to allow for a variety of interpretations that could be brought to the table by individuals from different cultures. Without opportunities for students to identify and express their own predilections, there's little hope that employing stereotypes of their home cultures would be of much use in stimulating discussion or even authentic connections with the events, images or narratives introduced in the course. Misunderstandings of the content, misreading of assignment, as well as disappointment and dissatisfaction with the course, would be likely. Krampetz [83] reports on a student's frustration with the way the instructor treated the politics in the student's home country. While the instructor may have had her own vision of a topic, it was a mistake not to provide space for other points of view where students' inside knowledge of her/his culture is appreciated and respected. Such a space was created in the course of Taiwanese-US online collaboration, where electronic discussions were based on readings about students' own culture rather than the culture of their counterparts [15]. Students in this study felt that cross-cultural communication was rewarding and non-intimidating experience that supported the development of intercultural competence.

Some international students may require additional time for taking tests and provided extra scaffolding if web design features used in the course are believed to slow down content acquisition [43].

2. Course Management and Housekeeping in a Third Space Course

Course management strategies determine how a student interacts with the instructor, peers and course content, but a third space course, as noted above, may need a revised course management structure that builds trust, student ownership and a collaborative atmosphere. In this section we focus on some potentially effective strategies for third space approaches to IODHE course management.

a. Participation and Interaction

In the U.S., educational institutions and their faculty sometimes assume two opposing views over how dense should be social interaction among and between online students and instructors within the course. Currently prevailing is the belief that higher quantity of interaction supports student satisfaction and student learning [103]. Those who share this belief emphasize the importance of interaction and chose to require frequent participation in discussions and often include activities, such as learning journals, where students' interaction with the instructor becomes mandatory. Such are strategies encouraged to be practiced among faculty of State University of New York Learning Network (SLN) [104]. Others, however, choose to minimize mandatory interaction both among students and between a student and instructor. Some of Northern Virginia Community College's online courses have introduced a *Tutorial Instructional Model* where learner-instructor interaction is built into the course assignment submission and feedback process. Students in these courses are not obliged to interact with an instructor beyond this requirement, nor do they have to interact with peers [105]. Such approaches make a third space more difficult to establish, but selection of culturally appropriate materials and non-dominant examples and exercises can be helpful in these cases.

Both conversation rich and minimal interaction courses are listed in Sloan Consortium collection of effective online practices. The SUNY SLN strategy is based on socio-cognitive theories and supports a constructivist approach to learning, where active interaction is seen as an effective learning environment. While we value online discussions, especially for humanities courses, we should point out that for many IODHE students participation in discussions could be very stressful and problematic due to many reasons discussed above. Moreover, some instructors may also feel uncomfortable if the social density of the course they teach online exceeds the level of interaction they generally have in on-campus courses. The Northern Virginia Community College approach is first of all meant to accommodate those instructors who generally do not have discussions in on-campus courses, though voluntary participation in discussions can be beneficial for some international students as well.

Whichever strategies the course facilitator chooses to undertake, strategies related to participation and interaction would have to capitalize on such concepts as mutual respect, openness, readiness to speak up and listen, and, in some cases, appreciation of silence. Labour et al. [21] believe that online instructors should be "explicit and transparent about their tutoring techniques." In their e-workshop designed for online practitioners working in multicultural environment, they suggest that online instructors first raise their own self-awareness "by reflecting on how we assess ourselves and how we communicate with, and present ourselves to, others". Openness and transparency, however, would have to be exhibited on both sides--the instructor's and students'. To generate a more thorough third space course, *Thriving in Academe* [106] recommends including students' and instructor's photos and requiring posting a short autobiographical sketch of each student, as well as administrating individual online conferences with each student via email or chat. Images and texts assist the online instructor in understanding the "codes of ethical values" [21], while helping both sides negotiate and establish third space compromises in a virtual classroom, thus diminishing the level of anxiety caused by confusing course expectations.

b. Groups

Team work, highly valued in the U.S. education, may also put an international student at a disadvantage. A third space classroom generally mixes together international and local students [65,106]). Such a

recommendation is based on the assumption that both groups would benefit from the versatility of knowledge and skills brought in by team members. Indeed, such grouping is vital for international students when a course assignment is designed for local students by a local instructor. While collaborating with peers of the dominant culture, international students learn procedures for putting together multimedia presentations, making posters or role-playing, i.e. activities common for the host culture. In the situation where an international student is in the minority, she/he is expected to play in accordance with dominant culture rules and agree with the majority when negotiating for consensus. Third space instructors, however, work against seeing any student as an outsider and find ways to engage such students and honor their presence in the course.

In a third space IODHE course, indeed, team work needs to be designed to minimize the dominance of one culture. Of course working in virtual teams is more complicated than in face-to-face context, but achieving group cohesion, so important for successful team work, may be complex. Ishikawa [102] points out that "various cultures have different processes for making a decision in a group" and agrees with Dickson who argues that in virtual teams "group cohesion must take precedence over cultural differences" [107] as cited in [102]. Among recommended strategies, Dickson suggests that a multicultural team needs a member who would bridge cultural gaps through personal intervention. More feasible would probably be to design such team projects that would not require a final product to be aligned with one dominant culture. In addition, teams may be culturally homogeneous, but that they should also be exposed to other cultures through cross-team reviews/evaluations.

c. Pacing

Numerous studies suggest that such variables as workload and procrastination may increase drop-out rates among online students [108, 109, 110]. Finding reasonable course pacing becomes a matter of retaining students in class. Foreign language speakers with limited exposure to educational values of the host culture may find the amount of reading and assignments per course module daunting. While there is no formula that may calculate how much work and within what time frame would be reasonable, there is evidence to justify those instructors who practice flexibility with assignment deadlines. Such adjustments can be used as the subject matter for third space conversations about the tolerance for such shifts among class members.

Patton's study [59], which involved international and other non-traditional students studying in Australia, found that 89% of those who could not complete required assignments by regular deadline did complete the course when given the second chance. Not only does such a strategy allow students to spend more time on completing assignments, but it also accounts for cultural differences in perception of punctuality [102]. Moreover, some national course assessment systems (such as the Russian system) may diminish the importance of deadlines by having a single assessment point – the final exam (often oral). In the U.S., where tests and graded assignments are given throughout a semester and each assessment point is strictly scheduled, deadlines are supposed to be respected. To generate a third culture compromise, Ishikawa [102] recommends discussing the concept of "time" at the beginning of the course, while Patton [59] argues for flexible deadlines. Taken together, these strategies will make both a student and an instructor responsible for maximizing successful completion rates.

d. Feedback

Frequent and easily interpretable feedback is a key to establishing productive communication between the students and the instructor and can be an occasion for illustrating the third space nature of an IODHE course. The importance of feedback as a form of assessment and a means of work improvement is well documented in educational literature [111]. But the form of the feedback may constrain its effectiveness. Ciano [81] suggests considering the appropriateness of direct criticism when providing feedback.

According to Ciano, American-style feedback is relatively direct and may offend some students. On the other hand, Elizarova [112], as well as our own experience, shows that many U.S. faculty members avoid the language that directly points out at flaws and wrap their critique in a form of suggestions, which some international students take only as advice one does not need to follow. Open discussion of this difference in the third space course can generate a resolution acceptable to all parties.

In third space IODHE, feedback also becomes a form of ongoing two-directional communication. It is not only an instructor who is to provide constructive, clear and timely feedback on students' work, but also students themselves who are to express their thoughts and feelings on their learning experience. Feedback from students could be obtained through self-reflection journals, bulletin boards, discussion forums, weblogs and other communication channels. These public and private spaces must be designed as safe environments for sharing one's concerns and anxieties, as channels for discussing course issues, and even as a place to share intimate information. Bretag [86] found that private email communication with her ESL students initiated personal friendship and indicated "movement towards a transcendent third space relationship." Appreciation of silence, however, assumes that the instructor makes communication voluntary and/or creates low anxiety environment that supports third space ideas.

e. Assessment

Considering the diversity of assessment systems worldwide, course instructors may have to reconsider their typical requirements that reflect one dominant culture. For example, requirements for the quality and quantity of online discussions in courses designed in the U.S. often reflect only "western" educational values that encourage eloquence, wordiness, originality, grammatical and spelling accuracy, frequency, and so on. Courses opened to international audience would need to consider the linguistic abilities of foreign language speakers and their readiness to speak up, critically reflect on readings, and use rules of rhetoric appropriate for academic writing. Depending on the course discipline and audience, the strategies for dealing with cultural mismatch in course assessments may include acceptance of language imperfections, lurking [19], mimicking dominant discourse [83], as well as language-switching tolerance [21]. Adjustment of assessment criteria may have to involve changes in grading scales and other forms of feedback.

f. Grading

Grading scales and numerical grading itself may be foreign to some IODHE students. Lamontagne found that to Arabic students, "the tradition of assigning a numeric value to intelligence, and to differentiate students based on this value has little inherent meaning" [113, p.10]. Calculation of points, designation of percentages earned for each assignment or the idea of bonus points may not be well comprehended by multicultural audiences. Assessment criteria meant to ensure fairness and objectivity may in fact turn against some IODHE students. Apparently, the grading system must be 1) well articulated and 2) flexible. It could be suggested that the instructor provides a general frame for assessment criteria in the form of rubrics, which are further developed and detailed by students themselves. As numerical grading (or assigning letter grades) may not be a part of some students' schemata for "how school work is assessed," the instructor may need to consider pass/fail forms of evaluation or other more descriptive forms of feedback.

V. GENERAL RECOMMENDATIONS

IODHE providers will inevitably face many of the issues related to four discourses – institutional, technology, students and faculty, and they will need to reconsider their institutional policies to accommodate needs of IODHE students and faculty. The list below offers recommendations that we believe to be particularly helpful to institutions participating or planning to participate in cross-

border/cross-culture online education.

1. . Design Courses that Target Specific International Audiences

Tailoring online courses to specific audience may help avoid at least some issues associated with cross-border/cross-culture education. Localizing specific courses for relatively homogeneous audiences or internationalizing courses in the same way universal design drives accessibility for special needs. Such courses should necessarily possess a low level of *cultural contextualization* [114] or high degree of *cultural portability* [115] to ensure their applicability in diverse cultural settings.

2. Provide Advance and Detailed Information

The gap existing between IODHE students' preparedness and faculty expectations needs to be filled in by a clear and detailed course syllabus easily available to prospective students *before* they sign up for the course.

3. Offer Proactive Student Support

To help students to make the right choice of the course or academic program and get prepared, institutions need to provide students with adequate advising and support prior to program or course registration. This support may come in the form of skill surveys, pre-assessment tests, tutorials, or pre-requisite courses as well as virtual advising and mentoring.

4. Provide Ongoing Student Support in a Variety of Communication Media

While 24/7 ongoing academic and technical support may not be feasible, institutions and individual faculty members need to make available prompt feedback in a variety of communicational media. Online library services with expertise in foreign languages are useful.

5. Train and Support your Faculty

Ongoing support and training for faculty should include onsite and online professional development for new online faculty and continuing professional support to returning faculty. Partnerships and team teaching with overseas experts should be encouraged.

6. Re-evaluate Policies on International Education

Successful IODHE practices require re-evaluation of existing departmental and institutional policies as well as national policies of the host culture. Such re-evaluation should take particular note of policies related to student and faculty recruitment, enrollment, immigration, fees, assessment, and residency requirements.

VI. CONCLUSION

In this paper we have shown how International Online Distance Higher Education is complicated by the discourses of institutions, technology, instructors and students, and we have explored ways that a third space approach to a IODHE course may require a different approach in all these areas to insure student success. The pathway to productive programs and student success is still evolving, so our research reviewed assumptions of virtual classroom technologies worldwide, and teaching and learning strategies that assume a third space approach.

As distance education incorporates new technologies such as mobile devices and ever more complex

multimedia tools, individuals and institutions involved in IODHE may continue to experience many old problems related to adequate academic and technology support unless a broader view of IODHE prevails. We acknowledge the pioneering projects represented in this review as evidence that broader view is possible.

VII. ABOUT THE AUTHORS

Gulnara Sadykova is a doctoral student in the Department of Educational Theory and Practice, University at Albany. She is also an assistant professor at the Department of Romance and Germanic Philology, Kazan State University, Russia. She holds an advanced degree in Comparative Linguistics from the same university. Her research interests include cross-culture/cross-border distance education, technology-assisted language teaching/learning, and online learning.

Jennie Dautermann is Teaching Learning and Technology Program Manager at the SUNY Center for Professional Development in Syracuse. She is a former faculty member in the Technical Communication program in English at Miami University, Oxford, Ohio where she also served as Director of College Composition and Associate Dean of Arts and Science. She holds a PhD in Rhetoric and Composition with a specialty in Technical Communication from Purdue University. Her research interests and publications address teaching with technology, writing in non-academic and second language settings, and qualitative research methods.

VIII. REFERENCES

1. ***Open Doors 2005:*** *International Students in the United States*. Press release, 2005. http://opendoors.iienetwork.org/?p=69736.
2. **Marginson, S.** Don't leave me hanging on the Anglophone: The potential for online distance higher education in the Asian-Pacific Region. *Higher Education Quarterly* 58(2/3): 74–113, 2004.
3. **van der Wender, M.** *The Role of US Higher Education in the Global E-learning Market.* Research and Occasional Paper Series CSHE.1.02, Center for the Study of Higher Education, University of California, Berkeley, (Berkeley: CSHE), 2002. http://cshe.berkeley.edu/publications/docs/ROP.WendePaper1.02.pdf.
4. **McIsaac, M. S.** Online Learning from an International Perspective. *Educational Media International* 39(1): 17–21, 2002.
5. **Bentley, J. P. H, M. V.Tinney &B. H. Chia.** Intercultural Internet-based Learning: Know your audience and what it values. *Educational Technology Research and Development* 53(2): 117–127, 2005.
6. **Lauzon, A. C.** Situating cognition and crossing borders: resisting the hegemony of mediated education. *British Journal of Educational Technology* 30(3): 261–276, 1999.
7. **Darrup-Boychuck, C.** Harnessing the power of the Internet for international student recruitment. *The Technology Source*: January/February 2002. http://ts.mivu.org/default.asp?show=article&id=1034.
8. **Sedgwick, R.** Online education may impact foreign recruitment. *World Education News & Reviews* 12(2): March/April 1999. http://www.wes.org/ewenr/99mar/research.htm.
9. **Harley, D., S. Lawrence, S. Ouyang & J. L. White.** (Eds). *University Teaching as E-business? Research and Policy Agendas.* Selected Conference Proceedings, University of California, Berkeley, October 26–27, 2001.
10. **Australia's Competitors in International Education**: July 2005 Update. *Australian Educational International:* July 2005. http://aei.dest.gov.au/AEI/PublicationsAndResearch/Publications/CompAnalysisJuly05_pdf.

11. **Adam, S.** *Transnational Education Project Report and Recommendations.* 2001. http://eees.universia.es/documentos/otros/complementarios/ transnational-education-project.pdf.
12. **Knipe, R.** Personal communication. Genesee Community College, Batavia, NY, 2007.
13. **Sedgwick, R.** Diploma mills go digital. *World Education News & Reviews* 13(4): 2000. http://www.wes.org/ewenr/00july/feature.htm.
14. **Belz, J. A.** Social dimensions of telecollaborative foreign language study. *Language Learning & Technology* 6(1): 66–81, 2002.
15. **Liaw, M.** E-learning and the development of intercultural competence. *Language Learning & Technology* 10(3): 49–64, 2006.
16. **Cole, J. & B. Robertson.** Using market segmentation to develop a large section, web-enhanced survey course. *Innovate* 2(4): 2006. http://www.innovateonline.info/index.php?view=article&id=61.
17. **Collis, B.** Designing for differences: cultural issues in the design of WWW-based course-support sites. *British Journal of Educational Technology* 30(3): 201–215, 1999.
18. **Al-Jarf, R. S.** Cross-cultural Communication: Saudi, Ukrainian and Russian Students Online. ERIC Document Reproduction Service No. ED489964, 2004.
19. **Howell, S., M. C. Harris, S. A. Wilkinson, K. Zuluaga, & P. Voutier.** Teaching mixed-mode: A case study in remote delivery of computer science in Africa. *International Media Educational* 41(4): 297–306, 2004.
20. **Wiesenberg, F. & E. Stacey.** Reflections on teaching and learning online: Quality program design, delivery and support issues from a cross-global perspective. *Distance Education* 26(3): 385–404, 2005.
21. **Labour, M., C. Juwah, N. White & S. Tolley.** *Online Tutoring e-Book: Culture and Ethics: Facilitating Online Learning*, 2000. http://otis.scotcit.ac.uk/onlinebook/otisT6p.htm.
22. **Branden, J. V. & J. Lambert.** Cultural issues related to transnational Open and Distance Learning in universities: a European problem? *British Journal of Educational Technology* 30(3): 251–260, 1999.
23. **Distance Degree Programs: Course Basics.** Washington State University website. http://www.distance.wsu.edu/courses/basics.asp.
24. **Adkins, M.** Practice: Syllabus display and time on task. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/241.
25. **Oaks, M.** Practice: Introduction to course and professor welcomes learners. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/242.
26. **Jiang, M.** Practice: Strategies for mentoring online adult learners in a competency-based degree program. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/248.
27. **Cochrane, P.** Practice: Proactive academic advising for distance students. *Sloan-C Effective Practices*, 2004. http://www.sloan-c.org/node/381.
28. **Sax, B.** Practice: Wizards: Student tutors help peers learn. *Sloan-C Effective Practices*, 2002 http://www.sloan-c.org/node/240.
29. **Benke, M**. Practice: Capella University's online writing support center. *Sloan-C Effective Practices*, 2003. http://www.sloan-c.org/node/389.
30. **Clerkin M. J.** Practice: A comprehensive plan for preparing online students. *Sloan-C Effective Practices*, 2004. http://www.sloan-c.org/node/393.
31. **DiPaolo, A.** Practice: Courselets designed for custom tutorials. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/239.
32. **Schechner, K.** Practice: Creation of focused educational planning environment meets army student needs. *Sloan-C Effective Practices*, 2004. http://www.sloan-c.org/node/234.
33. ***Maryland Faculty Online***. http://www.mdfaconline.org/index.html.
34. **Puzziferro, M.** Practice: Supporting online adjunct faculty: A virtual mentoring program. *Sloan-C Effective Practices*, 2004. http://www.sloan-c.org/node/365.
35. **Pickett, A**. Practice: Faculty development process. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/347.

36. **McNaught, C**. Development and support for the global e-teacher. *Global Educator* 2003. http://www.globaled.com/articles.html.
37. **Kurt, L.** Internationalization of higher education: OECD perspectives. In Harley, D., Lawrence, S., Ouyang, S., & White, J.L. (Eds). *University Teaching as E-business? Research and Policy Agendas.* Selected Conference Proceedings, University of California, Berkeley (October 26–27, 2001), 2002. http://cshe.berkeley.edu/publications/publications.php?id=38.
38. **King, B.** Refocusing quality: moving towards 'extreme evaluation. In *Proceedings of the 11th Cambridge International Conference on Open and Distance Learning*: 96–100, 2005. http://www2.open.ac.uk/r06/conference/papers2005.pdf.
39. ***Internet World Stats:*** *Usage and Population Statistics*, 2007. http://www.internetworldstats.com/stats.htm.
40. **Würtz, E**. A cross-cultural analysis of websites from high-context cultures and low-context cultures. *Journal of Computer-Mediated Communication* 11(1): article 13, 2005. http://jcmc.indiana.edu/vol11/issue1/wuertz.html.
41. **Evers, V.** Cross-cultural understanding of graphical elements on the DirectED website. In Smith, A (Ed.), *Proceedings of Annual Workshop on Cultural Issues on HCI* (5 December 2001), Putteridge Bury, University of Luton, 2001.
42. **Marcus, A. & E. W. Gould.** Cultural dimensions and global web user-interface design: What? So What? Now What? In *Proceedings of the 6th Conference on Human Factors and the Web.* Austin, Texas, 2000. http://www.amanda.com/resources/hfweb2000/AMA_CultDim.pdf.
43. **Faiola, A., & S. A. Matei.** Cultural cognitive style and web design: Beyond a behavioral inquiry into computer-mediated communication. *Journal of Computer-Mediated Communication* 11(1): article 18, 2005. http://jcmc.indiana.edu/vol11/issue1/faiola.html.
44. **Pan, C.-C, M.-H. Tsai, P. –Y. Tsai, Y. Tao & R. Cornell.** Technology's impact: Symbiotic or asymbiotic impact on differing cultures? *Educational Media International* 40(3/4): 319–330, 2003.
45. **Thompson, L. & H.-Y. Ku,.** Chinese graduate students' experiences and attitudes towards online learning. *Educational Media International* 42(1): 33–47, 2005.
46. **Shield, P., B. Atweh & P. Singh.** Utilising synchronous web-mediated communications as a booster to sense of community in a hybrid on-campus/off-campus teaching and learning environment. In *ASCILITE Conference Proceedings, December 4–7, 2005, Brisbane, Australia.* http://www.ascilite.org.au/conferences/brisbane05/blogs/proceedings/70_Shield.pdf.
47. **Dorazio, P., C. Hickok & S. Thornton.** *Modeling the Global Workplace Using Emerging Technologies.* Paper presented at CIT Conference, May 2007.
48. **Warschauer, M.** Comparing face-to-face and electronic discussion in the second language classroom. *CALICO Journal* 11(2/3): 7–26, 1996.
49. **Ware, P. D.** From Involvement to Engagement in Online Communication: Promoting Intercultural Competence in Foreign language Education. Unpublished doctoral dissertation, University of California, Berkeley, 2003.
50. **Kern, R., P. Ware & M. Warschauer.** Crossing frontiers: New directions in online pedagogy and research. *Annual Review of Applied Linguistics* 24: 243–260, 2004.
51. **Dalsgaard, C.** Social software: E-learning beyond learning management systems. *European Journal of Open, Distance, and E-Learning:* 2, 2006. http://www.eurodl.org/materials/contrib/2006/Christian_Dalsgaard.htm.
52. **Vignare, K.** Practice: Getting started with Customized Online Course Pages. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/387.
53. **Robinson, M.** Practice: Distance learning online student orientation website. *Sloan-C Effective Practices*, 2005. http://www.sloan-c.org/node/377.
54. **Thomson, M.** Practice: Student/faculty help desk. *Sloan-C Effective Practices*, 2003. http://www.sloan-c.org/node/385.
55. **Bump, J.** Radical Changes in Class Discussion Using Networked Computers. *Computers and the Humanities* 24: 49–65, 1990.

56. **Morse, K.** Does One Size Fit All? Exploring Asynchronous Learning in a Multicultural Environment. *Journal of Asynchronous Learning Networks* 7(1): 2003. http://www.sloanconsortium.org/publications/jaln/v7n1/v7n1_morse.asp.
57. **Bohm, A., D. Davis, D. Meares & D. Pearce.** *Global Student Mobility 2025: Forecasts of the Global Demand for International Higher Education*. Canberra, IDP Education, Australia, 2002. http://www.idp.com/16aiecpapers/program/thursday/marketing2/ Bohm_2025Media_p.pdf.
58. ***The 2005 National Online Learners Priorities Report.*** Noel-Levitz Inc., 2005. https://www.noellevitz.com/Papers+and+Research/Research/ResearchLibrary/2005+National+Satisfaction+Report.htm.
59. **Patton, M. A.** The importance of being flexible with assignment deadlines. *Higher Education in Europe* XXV(3): 2000.
60. **Hall, E. T.** *Beyond Culture*. New York: Doubleday, 1976.
61. **Hall, E. & M. Hall.** *Understanding Cultural Differences.* Yarmouth, ME: Intercultural Press, 1990.
62. **Hofstede, G.** Cultural differences in teaching and learning. *International Journal of Intercultural Relations* 10: 301–320, 1986.
63. **Hofstede, G.** Cultures and Organizations: Software of the Mind: Intercultural Cooperation and its Importance for Survival. New York: McGraw Hill, 1991.
64. **Hofstede, G.** A case for comparing apples and oranges. *International Journal of Comparative Sociology* 39(1): 16–31, 1998.
65. **Biesenbach-Lucas, S.** Asynchronous discussion groups in teacher training classes: Perception of native and non-native students. *Journal of Asynchronous Learning* 7(3): September, 2003. http://www.sloanconsortium.org/publications/jaln/v7n2/index.asp.
66. **Lim, D. H.** Cross cultural differences in online learning motivation. *Educational Media International* 41(2): 163–173, 2004.
67. **Grushevitckaja, T. G., V. D. Popkov & A. P. Sadokhin.** *Osnovy Mezhkulturnoj Kommunikatcii: Uchebnik Dlya Vuzov*. Moscow: YUNITI-DANA, 2003.
68. **Shadbolt, D.** On-line training for multilingual markets: Localization is key to successful e-learning systems in Europe. *Multilingual Computing & Technology* 13: 51–55, 2002.
69. **Agar, M.** Culture: Can you take it anywhere? Invited lecture presented at the Gevirtz Graduate School of Education, University of California at Santa Barbara. *International Journal of Qualitative Methods* 5(2): article XX, 2006. http://www.ualberta.ca/~iiqm/backissues/5_2/pdf/agar.pdf.
70. **Samarawickrema, R. G.** Determinants of student readiness for flexible learning: Some preliminary findings. *Distance Education* 26(1): 49–66, 2005.
71. **Hewling, A.** Culture in the online class: Using message analysis to look beyond nationality-based frames of reference. *Journal of Computer-Mediated Communication* 11(1): article 16, 2005. http://jcmc.indiana.edu/vol11/issue1/hewling.html.
72. **Yeager, D. & J. Sivell.** *ESL Teachers' Perceptions of the Cultural Variables that Impact on Teaching and Learning in the SL Classroom.* Paper presented at the Annual meeting of the Canadian Association of Applied Linguistics (Quebec City, Quebec, Canada, May 2001). ERIC Document Reproduction Service No. ED 475738, 2001.
73. **van Dejk, T. A.** Jazyk, Poznanie, Kommunikatcija. Moscow, 1989.
74. **Gallini, J. K. & D. Barron.** Participants' perception of web-infused environments: A survey of teaching beliefs, learning approaches, and communication. *Journal of Research on Technology in Education* 34(2): 139–155, 2001–2002.
75. **Swan, K.** *Relationships between Interactions and Learning in Online Environments.* The Sloan Consortium, 2003. http://www.sloanconsortium.org/publications/books/pdf/interactions.pdf.
76. **Jiang, M. & E. Ting.** A study of factors influencing students' perceived learning in a web-based course environment. *International Journal of Educational Telecommunications* 6(4): 317–338, 2000.
77. **Becher, T.** Academic Tribes and Territories: Intellectual Enquiry and the Cultures of Disciplines. London: Open University Press, 1989.

78. **Bauer, H.** Barriers against Interdisciplinarity: Implications for studies of science, technology and society. *Science, Technology and Human Values* 15(1): 105–119, 1990.
79. **Bradbeer, J.** Barriers to Interdisciplinarity: Disciplinary Discourses and Student Learning. *Journal of Geography in Higher Education* 23(3): 381–396, 1999.
80. **O'Quinn, L. & M. Corry.** Factors that deter faculty from participating in distance education. *Online Journal of Distance Learning Administration* 5*(*4): 2002. http://www.westga.edu/~distance/ojdla/winter54/quinn54.html.
81. **Ciano, L.** Special Considerations When Teaching Non-native English in an Online Environment. Paper presented at the Eighth Annual Teaching in the Community Colleges Online Conference "The Student Experience in Online and Hybrid Courses" (April 22–24, 2003). http://makahiki.kcc.hawaii.edu/tcc/2003/conference/presentations/ciano.html**.**
82. **Kaplan, R.** Cultural thought patterns in inter-cultural education. *Language Learning* 16: 1–20, 1966.
83. **Krampetz, E. M.** *Writing across Cultures and Contexts: International Students in the Stanford Study of Writing.* A Monograph in partial fulfillment of the requirements for the degree of Master of Arts. Stanford University, 2005.
84. **International Students Need Help Online**. Interview with representatives of City University vocational school, Bellevue, Washington. *Magna*, October 1, 2005. http://www.magnapubs.com/issues/magnapubs_der/9_19/news/597972-1.html.
85. **Bhabha, H. K.** *Location of Culture.* London and New York: Routledge, 1994.
86. **Bretag, T.** Developing 'third space' interculturality using computer-mediated communication. *Journal of Computer-Mediated Communication* 11(4): article 5, 2006. http://jcmc.indiana.edu/vol11/issue4/bretag.html.
87. **Hannula, M.** Third space: Merry-go-round of opportunity. *Kiasma Magazine* 12(1): 2001. http://www.kiasma.fi/www/viewresource.php?lang=en&id=3LoHIn6PkQfTgv09.
88. **Culturally Situated Design Tools: Teaching Math through Culture.** Rensselaer Polytechnic Institute website. http://www.rpi.edu/~eglash/csdt.html.
89. **Multicultural, Cross-cultural & Intercultural Games & Activities.** Wilderdom Website. http://wilderdom.com/games/MulticulturalExperientialActivities.html.
90. **Distance Education**. University of Wisconsin - Platteville. Website. http://www.uwplatt.edu/disted/degrees/textbook.html.
91. **How It Works.** University of Phoenix Online Website. http://www.uopxworld.com/howitworks.asp.
92. **MERLOT** Website. http://www.merlot.org/merlot/index.htm.
93. **Dunning, J.** Practice: Repurposeable learning objects: the TALON learning object system. *Sloan-C Effective Practices,* 2003. http://www.sloan-c.org/node/230.
94. **Virtual Science Lab.** The University of Virginia Website. http://www.virlab.virginia.edu/VL/home.htm.
95. **Campbell, O**. Practice: Cost-effective distributed learning with electronics labs. *Sloan-C Effective Practices,* 2003. http://www.sloan-c.org/node/263.
96. **Bishop, T.** Practice: Virtual biology laboratory. *Sloan-C Effective Practices,* 2003. http://www.sloan-c.org/node/1097.
97. **Carnevale, D.** Baking Soda, Vinegar, and Measuring Cups Become Lab Materials for Online Chemistry Course. *Chronicle of Higher Education* November 12, 2002. http://chronicle.com/free/2002/11/2002111201t.htm.
98. **Alm, R.** Practice: Re-creating the studio-based model online for art and design education. *Sloan-C Effective Practices*, 2003. http://www.sloan-c.org/node/333.
99. **Student Services.** Long Beach City College Library Website. http://success.lbcc.edu/resources-spanish.htm.
100. **QuestionPoint; 24/7 Reference Services.** http://questionpoint.org/.
101. **Sener, J.** Practice; live online interactive library services–statewide. *Sloan-C Effective Practices,* 2004. http://www.sloan-c.org/node/282.

102. **Ishikawa, L**. *Intercultural Aspects of CMC.* Lecture notes for DMST 4503 Seminar in Internet Communication. University of Denver, 2002. http://www.du.edu/~jrutenbe/4503/intercultural.htm.
103. **Shea, P., K. Swan, E. Fredericksen, & A. Pickett.** Student Satisfaction and Reported Learning in the SUNY Learning Network: Interaction and Beyond. *Online Education* v.3. Proceedings of the 2001 Summer Workshop on Asynchronous Learning Networks. Needham, MA: Sloan Center for Online Education, 2002.
104. **Sener, J.** Practice: Student satisfaction and reported learning: Interaction, learning community formation, and beyond. *Sloan-C Effective Practices*, 2002. http://www.sloan-c.org/node/397.
105. **Hatheway, B.** Practice: Tutorial instructional model. *Sloan-C Effective Practices,* 2002. http://www.sloan-c.org/node/223.
106. **Thriving in Academe**: The changing world of international students. *NEA Advocate Online*, December 2006.
107. **Dickson, C. C.** Intercultural Communication in Virtual Teams: Case Study of the Japan-America Student Conference. A Thesis Outline, 1999.
108. **Hartman, J. A**. *ATFY-R: Psychometric Properties and Productive Value for Academic Performance in Online Learning.* Unpublished Doctoral Dissertation. The University of Alabama, Tuscaloosa, AL, 2001.
109. **Nash, R. D.** Course completion rates among distance learners: Identifying possible methods to improve retention. *Online Journal of Distance Learning Administration* 8(4): 2005.
110. **Richards, C. N. & D. R. Ridley.** Factors affecting college students' persistence in on-line computer-managed instruction. *College Student Journal* 31(4): 1997.
111. **Palloff, R. M. & K. Pratt.** *Collaborating Online: Learning Together in Community.* Jossey-Bass, San Francisco, CA, 2005.
112. **Elizarova, G. V.** *Kultura i Obuchenie Inostrannym Yazykam.* St. Petersburg: KARO, 2005.
113. **Lamontagne, M.** Communities of practice in an Arabic culture: Wegner's model and the United Arab Emirates implications for online learning. *Turkish Online Journal of Distance Education* 6(3): article 1, July 2005.
114. **McLoughlin, C.** Culturally inclusive learning on the web. In K. Martin, N. Stanley and N. Davison (Eds.), *Teaching in the Disciplines/Learning in Context*. Proceedings of the 8th Annual Teaching: 272–277, 1999. http://lsn.curtin.edu.au/tlf/tlf1999/mcloughlin.html.
115. **McBrien, K.** Developing localization friendly e-learning. *Learning Circuits* May 2005. http://www.learningcircuits.org/2005/may2005/mcbrien.htm.

THE INFLUENCE OF ONLINE TEACHING ON FACE-TO-FACE TEACHING PRACTICES

Norma I. Scagnoli, Ph.D.
Lydia P. Buki, Ph.D.
Scott D. Johnson, Ph.D.
University of Illinois at Urbana Champaign

ABSTRACT

The integration of online technologies in educational practice is rendering new opportunities for teaching and learning. It is known that instructors who have taught fully online courses have acquired new skills and have had the opportunity to implement novel pedagogical practices in the online environment. However, it is unclear whether direct exposure to fully online teaching facilitates the integration of technology in traditional classrooms. This qualitative investigation examined the transfer of four experienced faculty members' pedagogical practices from online to face-to-face teaching. Results of this case study show that (a) the instructors' online teaching experience influenced their perceptions and understanding of online pedagogical strategies, and (b) the transfer of pedagogical strategies back to the classroom is a complex process influenced by the instructors' teaching style, satisfaction with working in the online environment, and the similarity of content and context between online and face-to-face courses. These findings have the potential to inform innovations in faculty training and development and to promote further research in this area.

KEYWORDS

Pedagogy, Collaboration, Technology, Accountability, Online, Face-to-face

I. INTRODUCTION

A growing body of literature suggests that when instructors venture out of the traditional classroom to engage in online teaching, they acquire new skills and competences [1, 2, 3] and perform roles different than those performed in the classroom [4]. For example, faculty who teach online gain familiarity with uses of technology, online pedagogical practices, alternative forms of accountability, and novel applications of techniques for collaborative learning [5, 6, 7, 8, 9]. The fact that experience in Internet-based distance education seems to facilitate the integration of online technologies into the classroom has been raised as a secondary finding in several studies [5, 6, 8, 9, 10, 11, 12]. It is yet unclear, however, how the process of exposure to fully online teaching influences this integration. Suter concluded that "The teaching of online classes resulted in the faculty's greater use of technology-related learning activities in their on-site classes" [12, p. 234]; Fetzner indicated that faculty "change their teaching process and bring lessons learned in the online environment to campus-based classrooms" [6, p. 237]; and Guidera quoted a faculty member who said "I now use online tools extensively and routinely to enhance my regular classroom courses" [13, p. 111]. These findings, although limited in scope, suggest that to facilitate technology integration, faculty should be trained in distance education methods and technologies and should be encouraged to use those methods back in the classroom [2, 8, 9, 14].

Our study aimed to close the current gap in research by exploring, in depth, the influence of online teaching on face-to-face teaching practices. To reach a better understanding of what practices are brought

back to the classroom by those who have been exposed to fully online teaching, we examined both the type of changes and the motivation behind those changes. Teaching practices and the transfer of pedagogical practices from the online to the face-to-face classroom were analyzed from the perspective of the instructor, the actual teaching materials, syllabi, course plans, and other course documents.

II. RESEARCH DESIGN

This study followed a qualitative research design and more specifically, a collective case study [15]. The overarching question that motivated this investigation was: "*How does previous online teaching experience influence upcoming classroom teaching practice?*" Additional questions that guided the data collection and analysis included: How do faculty describe their classroom teaching experience after teaching online? Are there changes in face-to-face instruction that can be attributed to the experience of previous online teaching? What pedagogical strategies do instructors transfer from online to face-to-face teaching? What benefits do they expect from that transfer?

A. Participants

Four faculty members with extensive previous teaching experience in graduate programs in higher education, both in face-to-face and online courses, participated in this study (see Table 1). Participants had to meet the following inclusion criteria: (a) at least 3 years of classroom teaching experience in higher education, (b) had taught at least one graduate distance education course via the Internet, (c) had taught at least one graduate face-to-face course equivalent in discipline and credits to the course taught online, (d) had taught at least one face-to-face course before and after having experienced at least one semester teaching online, and (e) had taught the online course as part of an established curriculum in a degree program.

It was important for faculty to have previous teaching experience because it is known that experienced instructors have a different way of incorporating changes into their teaching and, seasoned in their profession, they have achieved higher competence in problem solving than novice teachers [16, 17]. As Table 1 shows, all four faculty members were seasoned teachers with the majority having over 10 years of classroom teaching and at least 2 years of online teaching experience at the time of the study.

Participant	Teaching Experience	Online Experience	Background	Department
Prof. Allen	14 years	2 years	Adult ed., organizational development	Human Development
Prof. Bilbao	33 years	8 years	Adult ed., Psychology	Teaching & Learning
Prof. Chang	14 years	6 years	Training and organizational development	Human Development
Prof. Davis	40 years	6 years	Psychology of teaching and learning	Teaching & Learning
Average	25.25 years	5.5 years		

Table 1: Participants' Background Information

The identity of the faculty members and identifying information are altered in this article to protect the confidentiality of the participants. For example, all participants are presented as male participants. Although this masks the gender diversity in the present example, it was important to characterize everyone as being of the same gender to protect confidentiality given the small sample size.

The courses taught by the participants at the time of the study were all within the social sciences (see Table 2). As shown in Table 2, two of the participants were teaching the same course online and face-to-face and the other two were teaching two different courses in these modalities.

Participant	Online course	Face-to-face course
Prof. Allen	Advanced graduate course (Summer)	Foundation course in Human Development (Fall)
Prof. Bilbao	Theories of Education (Spring)	Basic theory of Teaching & Learning (Summer)
Prof. Chang	Advanced course in Human Development (Summer)	Advanced course in Human Development (Fall)
Prof. Davis	Foundations of Teaching & Learning (Spring)	Foundations of Teaching & Learning (Summer)

Table 2: Participants' Types of Course Assigned

B. Method

To enhance credibility, this case study included multiple sources of information as well as multiple methods of data collection [18, 19, 20]. Specifically, three methods of data collection were used in six data-collection stages (see Figure 1) which included interviews, observations, and study of documents. The process of data collection took five months to complete and it was conducted by one researcher.

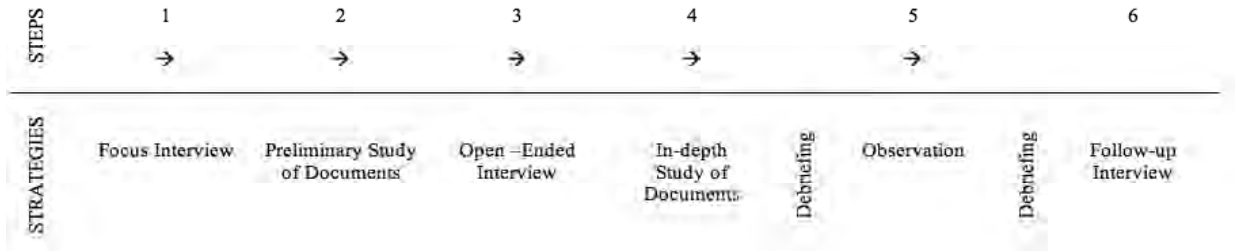


Figure 1. Steps in Data Collection

Focus interview. First, the primary author met individually with each faculty member to learn about the faculty member's teaching philosophy. This in-person interview took 40 to 60 minutes and was conducted following an interview guide.

Preliminary study of documents: The researcher examined the course syllabi and other documents (i.e., class schedules, teaching statements, or semester activities plan) with the purpose of gaining an improved understanding of the organization and content of the courses taught by each instructor. The information examined included course description, expectations for the course, the type of instructional strategies proposed, any possible evidence of use of online strategies, details of the technologies used in the class, as well as other information that could help the researcher better understand the courses that were being explored.

Open-ended interviews: The primary author met with the faculty members for a second time with the purpose of inquiring about the faculty members' perception of the influence of online teaching on their classroom teaching. This interview took about 90 minutes and it followed an interview guide that included questions about pedagogical practices and skills acquired in online teaching. The questions in

the interview guide were drawn from the principal investigator's experience and from the research study by Schoenfeld-Tacher and Persichitte [21], which provided information about the knowledge and abilities that instructors possess or acquire when teaching online.

In-depth study of documents: An exhaustive review of the course documents (i.e., course syllabi, assignments, assessments, instructional design) was conducted with the aim of examining the pedagogical and teaching style of each participant in both online and face-to-face courses. Two sets of documents were analyzed for each case. One set was from the online course previously taught by the participant, and the other was from the face-to-face course taught subsequently, that is *after* teaching the online course. For example, one of the online courses studied was taught in the Fall semester and the face-to-face course was taught the following summer. In this way, the researcher could determine if there was any influence of online teaching in the face-to-face teaching. The instrument used by the researchers to gather information in this study of documents was organized by phases of instruction [22], namely (a) presenting information, (b) guiding the learning process, (c) practicing or applying new concepts or skills, and (d) assessing learning.

Direct observation: This stage consisted of direct observation of face-to-face classes. An average of three face-to-face classes was observed for each case. It took two months to complete the direct observation stage for each case. The observations focused on identifying the types of activities performed by the instructor and on uncovering possible evidence of integration of Internet applications in face-to-face teaching. For example, evidence could include the use of the Internet in the instructors' communications with students, in students' interactions with each other (such as use of online discussion forums in the face-to-face class), or in students' preparation of assignments (such as the use of the internet for research or group activities, or the use of weblogs for writing assignments instead of printed papers).

Follow-up interviews: The primary author sent each study participant a summary of the data collected for member checking. A week later the primary author met individually with each participant to conduct the last interview of the study. In this interview, the researcher presented the instructors with statements derived from the data collected throughout the study, and elicited reflections and comments that were subsequently integrated into the final version of the results.

C. Data Analysis

Data analysis began soon after the first step of data collection. This practice, known as *interim analysis*, facilitated the emergent design and the emergent structure of later data collection phases [23]. Each case was analyzed individually (i.e., within-case analysis) and was later compared and contrasted with the other cases (i.e., cross-case analysis). Within-case analysis involved a close scrutiny of each case, enabling the researcher to gain in-depth knowledge of each. The cross-case analysis facilitated a more holistic understanding of the phenomenon and contributed to building a general explanation that would fit all cases [24] while maintaining each case's identity and uniqueness. The cross-case study was not meant to generalize findings, but to provide a way to reach a more clear understanding and explanation of the phenomenon [19, 24].

III. RESULTS

A. Within-Case Analysis

This section presents the main features of each case, including descriptions of the instructors' teaching experience as well as the instructors' self-perceptions of the influence of their online teaching practices on

their classroom practices.

1. Case One: "Face-to-face Class in the Face-to-face Arena"

Professor Allen's teaching philosophy was marked by his interest to blend theory, research and practice to help students better understand the importance of the foundations in the field. His teaching style was that of a formal authority with a clear plan to cover content. At the same time, he guided students' interactions and developed participatory activities to keep them engaged in the topics presented that day. His classes were well organized, engaging, and centered around the instructor's guide and expertise.

After several years of rewarding experiences teaching in the traditional classroom, Professor Allen accepted the invitation to teach for an online program. He strongly believed that to replicate the success he enjoyed in the face-to-face experience, he needed to reproduce his face-to-face class as closely as possible in the online environment. Without prior online experience, for his first online course he moved an existing face-to-face course to the online environment, replicating pedagogical practices as much as he could. After the first semester teaching this course, he decided to make some changes to the online course given that he had a more clear understanding of the capabilities of the new online environment. The following semester he went back to classroom teaching without leaving his online course, and has continued teaching in the two formats ever since.

Two years after having started teaching online, Professor Allen's experience in the use of communication and information technologies was not quite evident in his face-to-face teaching. "I haven't gone from online to the face-to-face [teaching]; I have gone the other way around," he said. He perceived it was logical to move his current practices to the online environment but he did not see any advantages of bringing online practices to the face-to-face class. Professor Allen made a clear distinction between the pedagogical practices used in his online and his face-to-face courses. He said "I try to make my face-to-face class in the face-to-face arena," implying that he did not like to mix online and face-to-face activities in his classes. With one exception, his face-to-face teaching had no traces of the online teaching experience. Everything that happened in his face-to-face class was done, presented, or discussed in the classroom as it was before he taught online. Also, the uses he made of web technologies in his face-to-face course were the same as those he had relied on before teaching online: using the library's electronic reserves, using links to articles in electronic journals, and email for communication. The one exception was that he started to use his students' comments in the online course discussions to trigger interaction in the face-to-face classroom. He selected ideas, paragraphs, or chunks of comments from the interaction in the online class and adjusted them to be incorporated into sections of the presentation or activities in his face-to-face class. This transfer was clearly facilitated by the similarity of content covered in both courses. He said that this was a good strategy because it turned out to be a good catalyst for discussion in the face-to-face class.

He did not identify any other strategies or practices that he wanted to transfer to the face-to-face class. He perceived that the transfer of online technologies presented several constraints, such as the time required for implementation, the risk of student complaints, the lack of faculty incentives for the time devoted to integrating technology into face-to-face teaching, issues of intellectual property, and finally, no payoff in terms of enhancing the students' learning experience. For example, he believed that incorporating discussion forums in the face-to-face class would take extra time for students and would not add to their learning experience. He remembered one student in particular who said: "please, please, do not make us go online to work, don't add questions before class, don't add extra layers to our class assignment" and added that students do not need to use technology to engage in meaningful learning experiences.

In addition, Professor Allen said that uploading materials to the web was "quite a time intensive endeavor," and perceived that if he wanted to incorporate the use of new communication tools in his face-to-face class, it would take as long as it took when he was creating his online class. He did not see any reason to use his time doing that for a class that already interacted very well face-to-face. He added:

> …one of the challenges is that if you place an X amount of time in teaching and technology at the expense of research, you jeopardize your career because the rewards aren't here for teaching; [they] are really for research and grant writing, so it is a delicate balance.

He also indicated concerns about intellectual property and copyright, which made him rethink the need to make class materials available online: "I don't put all my materials up in [Course Management System; CMS] for my face-to-face course because you upload things in a site like that, and students can access and take," he remarked. He added that he had once experienced a case of violation of copyright. He also indicated that he did not ask students to find class materials on their own on the web, because he has observed careless use of the web resources by students. He emphasized that students had to refer to scholarly publications found in the library or the web links recommended in the class. Encouraging the search for online resources could be an invitation to plagiarism or "an easy way out." He explained:

> I don't ask students to "Google" something on the Internet, because that is kind of the easy way out. I want them to go to the library and search in journals, also in online journals . . . sometimes students see Google as an invitation to do research in an easy way . . . and frequently the Google site or the Internet becomes the gospel.

2. Case Two: " Online Teaching has Changed Very Little [my] Face-to-face Teaching"

"Online [teaching] has changed very little my face-to-face [teaching]. You will see. Very little," said Professor Bilbao when we started talking about the influence that online teaching might have had on his face-to-face teaching. Professor Bilbao's teaching philosophy focused on the development of students' skills in critical thinking and collaborative learning, and he made it a priority to help students experience and develop an appreciation for learning communities. His teaching style was a combination of formal authority and facilitator. He preferred to closely guide students' learning experiences but at the same time he generated opportunities for them to learn on their own. Professor Bilbao had conducted research in the area of educational technologies some time before he was invited to design and teach his first fully online course. He reported that it was his previous exposure to information technologies (IT) that influenced his use of technology in his face-to-face course, and not his later exposure to online teaching. He admitted that his interest in community building had been very well supported by the use of IT, complementing the face-to-face interaction with email communication. IT had enabled him to reach individual students in a crowded face-to-face course, something he would never have achieved had his interaction with students been limited to the face-to-face arena in his large course with 250 students. Similar to Professor Allen's experience, Professor Bilbao started his online teaching by redesigning a face-to-face course to be taught in the online environment. His main objective was to replicate online the face-to-face class activities, especially the group and collaborative activities. Despite his previous experience in the use of technologies, he admitted that moving his course to the online environment was not a good experience from the very beginning. This first online course took longer to prepare than he had expected and demanded much more effort to teach than the face-to-face course. Moreover, he perceived that the activities did not have the same outcomes as when they were done face-to-face: "We could not keep up with all the activities we had designed. We could not give enough feedback because we could not keep up." After his first semester of online teaching, he revisited his practice and worked to redesign the online course to better reflect what he values: a collaborative and interactive learning experience. His first experience helped him realize that transferring pedagogical practices from one environment to the other was not a direct move, especially when the type of students in the online course was different from his face-to-face course. He indicated that to think about transferring back from the online environment to the

face-to-face course was something that had to be carefully studied before implemented:

> The online community that I am dealing with, they are self-directed learners; they are bringing an awareness that they have to be participants in the online learning. . . the undergrads [in the face-to-face course] are not self-directed learners, besides we are competing with other courses in their major…

Professor Bilbao voiced two main concerns about bringing online practices to the face-to-face course. One concern was related to the time that online interaction demanded: "we tried to use an online system [in the face-to-face course], but students were too busy with the other classes to come along," also, "how do you [instructor and TAs] keep up with all their answers?" and "how do you give good feedback to all?" He also feared that integrating online pedagogical strategies in his face-to-face course might hinder students' participation: "That is my nervousness about doing that, I am not sure that students will participate as openly."

In his eight years of online teaching, Professor Bilbao has transferred to the face-to-face class a few strategies from the online course with the purpose of enhancing students' engagement. Two of the strategies that he brought from online teaching to the classroom were the inclusion of students' comments sent to him by email about the topics in his weekly lectures, and the practice of publishing his lecture (with the students' comments) on the course website. This transfer was encouraged by students' satisfaction, since they found it very motivating to have the opportunity to participate in the class lectures, and later see the lecture and contributions published in the course website. Still, the strategies he transferred from the online course were minimal, and Professor Bilbao explained that he did not want to overwhelm students with class assignments or to limit his availability to engage in other meaningful learning interactions. He explained that his face-to-face course included enough activities to fully engage students in classroom interaction, and that adding online elements such as a forum would not add to the learning experience, but very likely could turn into an overload for both students and instructors. He added: "I don't have time to read all messages in the online class, so how do I do it if I have one [online forum] in my face-to-face class?" Another concern he had was related to the increased need for assistants to provide teaching support and supervision.

3. Case Three: "Multiple Alternatives to Engage Students' Learning"

Professor Chang's teaching philosophy was geared towards encouraging discovery and exploration, and providing opportunities that would match the students' interests and previous experiences. He believed that his role as instructor was to provide information through his lectures and feedback, and that students' learning also involved exploring and finding other sources that would help them understand better. His teaching style was that of a facilitator and demonstrator aiming to develop mastery and thinking skills in his students. Professor Chang taught the same courses in the Department of Human Development to two different groups of students, one online and the other face-to-face. His face-to-face classes showed the influence of his online teaching in several practices: (a) he had created an online discussion forum for face-to-face students' interaction outside of class; (b) students' contributions to the forum were part of the face-to-face class discussion; (c) the face-to-face course used a CMS that hosted all class materials and student assignments; and (d) the instructor used different online and printed sources of information for each topic and included materials that he had developed for the online course. The latter was one of the most important manifestations of the influence of online teaching in the classroom. The instructor said that in his online teaching he had learned that, besides the face-to-face contact, there were "multiple alternatives to engage the students' learning," and he had realized that he could enrich his face-to-face class by bringing the same variety of formats that he used in his online classes. These formats were presentation slides, audio files, text that was the script of his audio comments, and video files. This variety of materials was incorporated to the face-to-face course as an additional resource to complement

the classroom lectures.

About his approach to face-to-face teaching after his online experience, he said that he did not perceive a big difference between teaching online or face-to-face. "I feel equally responsible for structuring the process. . . . that is my overall responsibility. . . . I don't think that that is different." He added that his online teaching experience had taught him that organization and clarity in teaching made learning easier.

Professor Chang had both adopted and adapted activities from his online course to be used in his face-to-face course. For example, he incorporated the use of an online discussion forum for collaborative work, through which students could see and review each other's writing assignments. Such practice expanded the audience of students' work from the instructor only to peers as well. Professor Chang emphatically said:

> What I really, really like about the online environment is the ability for people to look at other people's work. It does a couple of different things: (a) for competitive people, [it] creates an opportunity to see where you fit with your peers; it tells you if you are competitive or not; (b) it extends the amount of things that you can learn, such as how others communicate … ; (c) it lets you learn your stuff and what others have been learning, too; [and] (d) it also teaches how others organize information. That is core in the course I teach, [so it] is like modeling what is expected, and what it does . . . I don't have to make it explicit; it becomes very obvious I don't have to reinforce it. That is something that I could not do in a standard face-to-face classroom without the electronic support.

In sum, Professor Chang reported that the online environment hosted elements that clearly supported his teaching philosophy, such as fostering a community of learners, encouraging discovery and exploration, and providing opportunities for sharing interests and experience. He also reflected on the fact that transferring the use of a CMS to the face-to-face course helped with class organization and management.

4. Case Four: "A class Where there is Discussion Going On"

Professor Davis said that he first approached online teaching as an "elaborated correspondence course that used more sophisticated methods" for delivery of materials. But soon, he said, he realized that the use of the Internet did more than just facilitating the delivery of materials. Given that the Internet allowed for powerful interaction in the online environment, his online teaching moved from an independent-study-type experience to a more integrated and collaborative environment. His teaching philosophy has always focused on encouraging learning by exploration and individual discovery. His role in distance education now was that of facilitating the interaction within the student cohorts and the sharing of projects, which created as an opportunity for building "community knowledge." He also started exploring learning as a social construction of knowledge. As a result of this combination of inquiry and social constructivism, he believes that his role is to give encouragement to learners "to wonder about things . . . and students have the responsibility and my permission to do that."

There were three aspects of his face-to-face teaching that clearly demonstrated the influence of his online teaching experience: the use of online collaboration tools such as wikis and discussion boards, the implementation of a variety of peer-to-peer and group online activities for off-class interaction, and the setting of new rules for class attendance, which required students to attend not every day but only the last three sessions of the course. This last aspect was unusual for an on-campus course and, surprisingly, the class had a very high rate of student attendance.

Professor Davis said that the learning outcomes in his online course encouraged him to incorporate activities from the online class into his classroom teaching. "In the online course, I put most of my effort in the [course] organization; I give students a lot of latitude/opportunities to follow assignments," and the students' production was superior, "[because] most of them did a better job than the students in face-to-face." Therefore, he changed the face-to-face course structure and requirements to facilitate the integration with the online environment. The pedagogical strategies that Professor Davis used in his face-to-face teaching were a combination of traditional and online pedagogical strategies. For example, student-to-student interaction via the online forums was an important part of the face-to-face course:

> In the way that I created the forums, and the forum 0 [zero, for students-only communication], there is all the openness in the world to say something . . . students have things to say and don't have anybody to talk to… their little daily achievements in the classroom and their little failures . . . they really don't have many people to talk to… their spouses don't want to hear about it . . . and they don't have time to talk to colleagues in school about it. I think that these students need [a channel to communicate], and I am responsive to the needs, and they talk to each other in the forum. . . then they come to class, and they hardly talk to each other, and you see the conversation that is going on online and think they will communicate to each other, but they don't. Once one student said in class, "Finally I have a class when there is some discussion going on" and he was talking about the online discussion.

The way that the instructor handled communication with students in the face-to-face course was also very similar to how he handled it in the online class. He discouraged individual email communication in his face-to-face course in favor of the use of the discussion forum.

The instructor had also transferred activities and assignments from his face-to-face teaching to his online teaching practice, and then he had brought them back to the classroom in a new format. For example, essay writing, which was an important part of the activities in his face-to-face courses, became collaborative writing projects in wikis for both the online and the face-to-face courses; multiple web resources (a few suggested by the instructor and a lot suggested by students) were the source to engage students in self-exploration and inquiry; and e-portfolios became a requirement for online and face-to-face students. Of the four cases, this one was the only case that incorporated online assessment strategies in the face-to-face course. For example, the e-portfolio determined the course grade, and the evaluation and assessment of students' performance was based on the results of the (mostly online) activities completed. Both the online and face-to-face courses shared the same grading policy.

Motivation for Professor Davis to transfer online pedagogical strategies to his face-to-face class included both pedagogical and classroom management reasons. The implementation of the discussion forum for guidance and social interaction was motivated by an interest in enhancing learning and collaboration, as well as a way to improve the channels of communication among students and between the students and the instructor. The use of wikis as a tool for collaborative writing facilitated the "community construction of knowledge," a concept strongly supported by Professor Davis' teaching philosophy. Wikis also proved to enhance the quality of students' writing; he remarked that "writing for a wider audience makes students' work of a higher quality" compared to writing only for the instructor as their audience. The use of a CMS also provided flexibility and mobility of the course contents and interaction. Having the entire course available online substantially facilitated the learners' access to the course materials: "those that do not come to lecture have access to the lecture notes, slides, or readings," and they did not miss participating in the class interaction.

B. Cross-Case Analysis and Discussion

The data were analyzed across all the cases to achieve a more holistic understanding of the transfer of online practices into classroom teaching. This comparison and contrast of cases provides a general explanation that suits all cases while maintaining each case's identity and uniqueness. The results of the cross case analysis is organized by each research question.

a. How do faculty describe their classroom teaching experience after teaching online? Are there changes in face-to-face instruction that can be attributed to the experience of previous online teaching?

Instructors' descriptions of their teaching experiences suggests that new pedagogical practices used in online teaching are more likely to be transferred back to the face-to-face courses when the courses share the same content. For example, Professors Chang and Davis taught the same courses online and face-to-face, and in both cases the transfer of pedagogical strategies from their online practice back to the classroom was more evident than in the cases of Professors Allen and Bilbao, who taught different courses online and face-to-face. These results suggest that the efficiencies gained through the implementation of online activities in the same course that was taught in face-to-face format motivated a direct transfer from one format to the other. These findings are consistent with previous research suggesting that online teaching increases faculty members' readiness to integrate technology in the classroom [6, 13], and that instructors come back to the classroom with a new repertoire of pedagogical strategies [12]. The findings also suggest that possessing knowledge of online education practices and theory, as well as having some expertise using online applications, are not enough to guarantee transfer to the face-to-face environment, which is consistent as well with previous research findings [2, 11, 12]. The faculty members' descriptions of their experiences suggests that several factors influenced their decision to transfer teaching strategies acquired online to the classroom: (a) their teaching styles or preferences, (b) their perception of online and campus education, (c) their proficiency in the management of online applications, and (d) their previous experiences transferring pedagogical strategies from their face-to-face to their online classes. With regards to teaching styles, instructors who took on the role of facilitators and left room for student-led activities were more likely to bring online applications back to the face-to-face classroom. In contrast, instructors who played the role of the expert or formal authority were less likely to transfer the strategies used in the online class to their classroom teaching. They preferred to participate in all interaction in the class, and perceived that online education should replicate the on-campus instructor-centered teaching context.

With regard to instructors' management of online applications, those who emphasized the need for technical and graduate student support seemed less confident transferring online strategies to the classroom setting. Finally, instructors who described having more problems or higher workload in their move from face-to-face to online teaching showed less interest in transferring new strategies back to the face-to-face class, fearful that the move would bring similar problems and work overload.

b. What pedagogical strategies do instructors transfer from online to face-to-face teaching?

This investigation presents evidence that the transfer of pedagogical strategies varies across phases of instruction: presentation, guidance, practice and assessment [22]. In the phase of *presentation* of new materials, the strategies most commonly used online and transferred to face-to-face teaching included: (a) the use of similar presentation materials, namely online presentations, web pages, links, audio and video files, and text documents; and (b) the inclusion of student-generated content in the lectures or presentations.

In the phase of *guidance or interaction*, the most important transfer was the incorporation of online discussion forums and chat sessions in the face-to-face course as a way to respond to students' questions and for clarification of concepts.

In the *practice* phase, where students are expected to apply new knowledge or skills, there were three strategies that were transferred to classroom teaching: submission of assignments via online conference system or CMS, peer review of assignments, and collaborative writing or group work using online collaboration tools such as wikis.

Finally, the phase of a*ssessment* reflects the least transferred of online practices. Only one of the four participants, Professor Davis, had included in his face-to-face course an evaluation rubric that reflected assessment for the use of online strategies. Specifically, he assessed participation in the discussion forum and fulfillment of assignments in the online environment.

c. What benefits do they expect from that transfer?

There were multiple reasons that motivated the instructors to transfer pedagogical strategies from the online to the face-to-face course: (a) ability to improve learning outcomes, (b) ability to increase students' motivation, (c) interest in introducing new pedagogical practices, (d) ability to update class materials, (e) ability to engage students in different ways and appeal to different learning styles, (f) ability to facilitate access to class materials, (g) potential to improve communication, and (h) ability to re-organize and recycle teaching materials. In the following paragraphs, we provide a more detailed explanation of the motivations for transfer.

Better learning outcomes. Two factors motivated the transfer of pedagogical practices from the online course to the classroom: the results of comparisons of students' achievement between online and face-to-face students (i.e., "many of them [online students] do a better job than the students in face-to-face…"), and the discovery of an online pedagogical technique that resulted in good learning outcomes. Evidence of this was found in several comments by Professors Chang and Davis: "seeing each others' work [via the online forum] is motivating and enlightening …. and they [almost] set the bar for the quality of the writings,…" (Professor Davis)

Increased students' motivation. Professors Chang and Davis agreed that the use of peer review and collaborative writing in online learning had enhanced students' motivation and quality of work, "changing the audience of the students' work from me [the instructor] to the rest of the class" (Professor Davis).

Interest in introducing new pedagogical practices. Transfer was also motivated by the instructors' interest in transferring pedagogical practices that could be easily implemented when used in the face-to-face class (i.e., peer review activities and collaborative writing via wikis).

Ability to easily update class materials. Having the online class in a CMS made it easy to upload and update class materials. Three of the instructors thought that this was a practice that their face-to-face course could benefit from, so they either adopted a CMS for the face-to-face course (such as Professors Chang and Davis did), or they adopted one of the activities. Professor Bilbao, for example, put his students in charge of using web search for updating resources and information about recent research on class-related topics.

Ability to engage students in different ways. The online environment provided new ways for students to share their work or life experiences with the rest of the class. For example, Professor Davis indicated that when he saw students in the online class communicating and sharing information as colleagues, he decided that students would benefit if he provided that avenue in his face-to-face course. He then adopted the same online conferencing system that he used in the online course and subsequently observed similar engagement, collegiality, and sharing of experiences as in the face-to-face course.

Facilitated access to class materials. Three of the four participants reported that having the materials available via CMS or a web page enabled students' access to these materials, which could be an advantage for on campus students also. Consequently, they transferred this practice to the face-to-face class. Professor Davis reported "[I realized] those that were commuters could benefit with this system from [24/7 access] too."

Improved channels of communication. The use of a discussion forum and/or a CMS in the face-to-face course was motivated by the fact that it helped faculty communicate with the students, keep track of messages sent, and organize communication in the course. Professor Chang reported that he found it easier to post announcements on the WebBoard™ to communicate with students in the class rather than using email for that purpose. In addition, the use of synchronous systems allowed faculty to host online office hours so that students could reach them or their TAs remotely, without having to come to campus.

Ability to keep class materials organized. "… I learned I can do things with technology, get things organized well in advance... I could not do that before …," said Professor Chang explaining another reason why he transferred online practices to the face-to-face classroom.

IV. CONCLUSION

In response to the overarching question that guided this study, *How does previous online teaching experience influence upcoming classroom teaching practice?*, the findings provide evidence that online teaching experience has an influence on some face-to-face teaching practices, although not all instructors who have taught fully online courses transfer online practices to the classroom, as suggested by previous studies [2, 11, 12]. Our findings suggest that certain factors are more influential to instructors' readiness to transfer pedagogical practices from online teaching to the classroom. For example, transfer is more likely to occur when the instructor has had a satisfactory previous experience in the online environment, and when there is close similarity between the content and context of the online and face-to-face courses that the instructor is teaching.

In sum, this study suggests that the experiences that faculty members acquire when teaching online can produce a change in the instructors' perceptions and understanding of online learning. Their new understanding, in turn, may result in changes to their face-to-face teaching practices. The findings show that, contrary to previous research speculations, technological skills and familiarity with distance education theories are not enough to assure the transfer of online pedagogical practices to face-to-face teaching. The findings also suggest that the instructors' process of changing the instructional design of a face-to-face course to the online environment triggers a reflection of their own practices, or what the theory of transfer calls *forward-reaching transfer* [25]. This reflection of practice also boosts awareness of potential pedagogical uses and encourages instructors to make changes in their face-to-face practice. Results from this study have the potential to inform innovations in faculty training and development and to encourage further research in this growing area.

V. REFERENCES

1. **Boettcher, J. & R. Conrad.** *Faculty guide for moving teaching and learning to the web*. Mission Viejo, CA: League for Innovation in the Community College, 1999.
2. **Kosak, L., D. Manning, E. Dobson, L. Rogerson, S. Cotnam, S. Colaric, et al**. Prepared to teach online? Perspectives of faculty in the University of North Carolina system. *Online Journal of Distance Learning Administration* VII(III): 2004.
3. **Spector, J., & I. de la Teja.** *Competencies for Online Teaching*. Syracuse, NY, 2001.
4. **Berge, Z. L.** Facilitating computer conferencing: Recommendations from the field. *Educational Technology* 35(1): 22–30, 1995.
5. **Cho, K. & Z. L. Berge.** Overcoming barriers to distance training and education [Electronic Version]. *USDLA Journal*, 16, 2002. Retrieved December 9, 2004 from http://www.usdla.org /html/journal/JAN02_Issue/article01.html.
6. **Fetzner, M.** Institutional support for online faculty: Expanding the model. In J. Bourne and J. C. Moore (Eds.), *Elements of quality in online education: Practice and direction*, Vol. 4, pp. 229–243. Needham, MA: Sloan-C, 2003.
7. **McDonald, J.** Is "as good as face-to-face" as good as it gets? *Journal of Asynchronous Learning Networks* 6(2): 10–23, 2002.
8. **McKenzie, B. K., N. Mims, E. Bennett, & M. Waugh.** Needs, concerns and practices of online instructors. *Online Journal of Distance Learning Administration* 3(3): 2000.
9. **O'Quinn, L. & M. Corry.** Factors that deter faculty from participating in distance education. *Online Journal of Distance Learning Administration* 5(4): 2002.
10. **Jeris, L. & A. Poppie.** Screen to screen: A study of designer/instructor belief and actions leading to student outcomes in internet-based courses. Paper presented at the 43rd Adult Education Research Conference (AERC), Raleigh, NC, 2002.
11. **Smith, G. G., D. Ferguson & M. Caris.** Teaching over the Web versus in the classroom: differences in the instructor experience. *International Journal of Instructional Media* 29(1): 61–67, 2002.
12. **Suter, M.** College faculty's transition to online teaching: from classroom space to virtual space. Unpublished doctoral dissertation. Capella University, 2001.
13. **Guidera, S.** College teaching in the virtual classroom: Faculty perceptions of the effectiveness of online instruction. Unpublished doctoral dissertation. Bowling Green State University, 2000.
14. **Muilenburg, L. Y. & Z. L. Berge.** Barriers to distance education: A factor-analytic study. *The American Journal of Distance Education* 15(2): 7–24, 2001.
15. **Stake, R. E.** *The art of case study research*. Thousand Oaks, CA: Sage Publications, 1995.
16. **Cree, V. E. & C. Macaulay.** (Eds.). *Transfer of learning in professional and vocational education.* London: Routledge, 2000.
17. **Schunk, D.** *Learning theories: An educational perspective* (4th Ed.). Upper Saddle River, NJ: Pearson Education, Inc, 2004.
18. **Merriam, S. B.** *Qualitative research and case study application in education*. San Francisco, CA: Jossey-Bass Publishers, 1998.
19. **Miles, M. B. & A. M. Huberman.** *Qualitative data analysis : an expanded sourcebook* (2nd Ed.). Thousand Oaks, Calif.: Sage, 1994.
20. **Stake, R. E.** Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research*, 2nd ed., 435–454. Thousand Oaks, CA: Sage Publications, 2000
21. **Schoenfeld-Tacher, R. & K. A. Persichitte.** Differential skills and competencies required of faculty teaching distance education courses. *International Journal of Educational Technology* 2(1), 2000.
22. **Alessi, S. M. & S. R. Trollip, S. R.** *Computer-based instruction: Methods and development*. Englewood Cliffs, NJ: Prentice-Hall, 1985.
23. **Lincoln, Y. & E. Guba.** *Naturalistic inquiry*. New York: Sage, 1985
24. **Yin, R. K.** *Case study research design and methods* (3rd Ed.). Thousand Oaks, CA: Sage Publications, 2003

25. **Salomon, G. & D. N. Perkins.** Rocky roads to transfer: Rethinking mechanisms of neglected phenomenon. *Educational Psychologist* 24(2): 113–142, 1989.

VI. ABOUT THE AUTHORS

Dr. Norma I. Scagnoli,Ph.D. works as eLearning Specialist at the University of Illinois at Urbana-Champaign. Dr. Scagnoli has a PhD with emphasis in instructional technologies, and she has extensive experience in eLearning as instructor, administrator, and designer. Her research focuses on faculty development, instructional design and development and organization of elearning programs

Dr. Lydia P. Buki, Ph.D. is an Associate Professor in the College of Applied Health Sciences at the University of Illinois at Urbana-Champaign. Dr. Buki's research and professional interests are centered on health issues faced by Latina women in the United States.

Dr. Scott D. Johnson is CIO / Associate Dean for Online Learning in the College of Education at the University of Illinois at Urbana-Champaign. Dr. Johnson is also professor in the department of Human Resource Education. Dr. Johnson specializes in instructional design, instructional methods, and online learning.

Submission Guidelines for Authors

Please use the Sloan-C style guide and template, found on the Sloan-C website (http://www.sloanconsortium.org /jaln_guidelines) to format your paper submission. Using the template will facilitate publishing your paper in multiple formats. Please use Chicago Style for documenting references, and IEEE style for numbering references sequentially in the body of the manuscript and in the Reference section of the paper. Before submitting your paper to Sloan-C, please be sure to proofread and spell check your article.

Your final manuscript should be submitted in electronic format. Please use our online submission system at http://jaln.sloanconsortium.org/index.php.

Author's Warranty and Transfer of Copyright: An Author's Warranty and Transfer of Copyright must be completed, scanned and submitted to publisher@sloanconsortium.org or uploaded as a supplementary file to the submission website before an accepted manuscript is published.

Please see the Sloan-C website for more detailed submission guidelines:
http://www.sloanconsortium.org/jaln_guidelines.

The Journal of Asynchronous Learning Networks is published 3 to 4 times per year by Sloan-C in both electronic format and, beginning with Volume 8, Issue 4, in print format. The annual subscription rate is $225. Individual issues may be purchased when available.

To order, please visit http://www.sloanconsortium.org/publications/jaln/index.asp.