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In this issue:

Co-“Lab”oration: A New Paradigm for Building a Management Information Systems Course

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Co-"Lab"oration: A New Paradigm for Building a Management Information Systems Course

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Keywords: computer-mediated communication and collaboration, management information systems, stigmergic collaboration, laboratory-based learning, blackboard

1. WHERE WE CAME FROM

Background: Like many Computer Science (CS) departments, we experienced decreases in enrollment after the dot-com crash and were forced to scale back courses for majors. During this time, the School of Business, which does not have its own MIS faculty, adopted our department's Management Information Systems (MIS) as a required course for all business majors. MIS had been offered in our department as a lecture-based course covering classic MIS topics found in leading textbooks. The School of Business required the academic components of MIS but also wanted students to gain practical database and spreadsheet skills.

Our department is housed in an undergraduate liberal arts college with approximately 3400 students, a third of which are business majors required to take MIS. Information Systems (IS) courses including MIS are taught by the CS department which offers a CS bachelors degree and a minor in IS. Our department has 10 permanent fulltime faculty, six with Ph.D.'s in CS, one with an IS Ph.D., and three with CS Masters degrees.

The prerequisites for our MIS course are minimal – students may take an introductory spreadsheet course or pass an Excel skills exam administered by our department. Many business students take our Introduction to CS course or continue with the IS minor sequence by taking Database Design and Applications for Business followed by Survey of Information Technology.

To meet the School of Business' needs and to capitalize on our previous success with lab-based courses, the CS department decided to add a lab component to MIS. One of our department's primary objectives is to use hands-on laboratory experiences to facilitate active learning and student engagement. By switching to a lab-based format, we were able to leverage our department's experience developing lab-based courses. A surprising outcome was that the labs served as a vehicle for integrating Information Systems (IS) and CS concepts (Breimer, et al. 2009). The evolution of our MIS course has opened up opportunities for collaboration with a broader range of faculty, including faculty with CS-rich backgrounds. This situation offers unique opportunities and challenges with regard to collaboration. While we needed to share content and material with faculty colleagues new to teaching the course, we did not want to hand over prepackaged material.

To scale the course to many sections to meet the increased demand, we encouraged department colleagues to join in the lab development process. Adding a flexible process for lab revisions and placing lab materials in a shared repository ignited a flurry of activity. Many ideas surfaced on how to improve the labs, resulting in iterative revisions and eventually a common "look and feel" to the labs. Maintaining the consistency and quality of the labs is a critical success factor for our course. This encourages faculty to learn how to effectively collaborate, divide work fairly, and to establish workflow processes that result in continuous improvement.

Motivation: As the course evolved, we saw the advantage of involving a broader group of collaborators. Figure 1 shows the expansion of our collaborative efforts. The course progressed from a single faculty member's efforts to a collaboration involving students in the course and most of the CSIS department. As the scope of collaboration expanded, the level of sophistication of our collaboration increased as the outer stakeholders became the focus of our efforts. A future objective is to examine effective ways to broaden our collaboration to include business faculty, other institutions, and alumni of the course. Ultimately, it is the students themselves who will use these skills and concepts in their business careers, and can provide valuable feedback on how well the course prepared them for the business world.

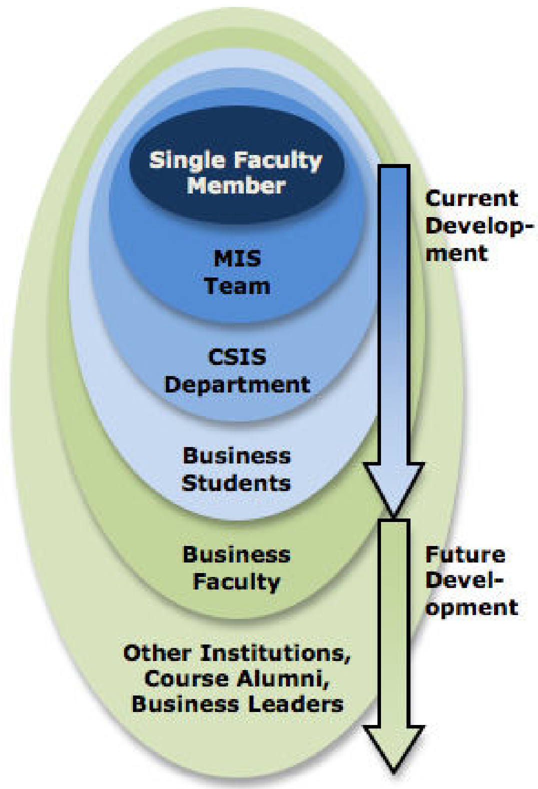

Figure 1: Collaboration Expansion

Coordination to Collaboration: In the early stages of the course, true collaboration was not taking place. Our small MIS teaching team was merely coordinating course efforts by agreeing on a textbook and a sequence of topics. The majority of original material in each course section was developed independently with very little content sharing. In developing the lab activities, we naturally moved from a coordination model to a cooperative model. Developing hands-on lab activities is challenging and time-intensive. Out of practicality, we adopted a divide and conquer approach where our initial team of three faculty members each developed three to four lab activities. We agreed to share our labs and review each other's work. The cooperative model proved to be very effective in terms of developing a semester's worth of quality labs in a short period of time.

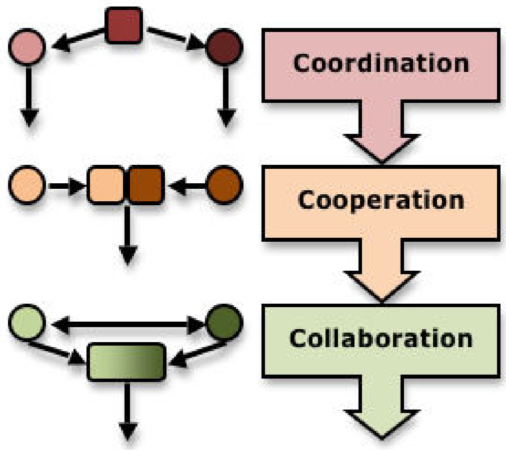

Figure 2: Teamwork Progression

In the cooperative model, course content was being shared, but each content item was developed independently. In improving our labs and developing new ones, we have finally progressed to a true collaborative model, where each lab represents collective edits and additions from many group members. Figure 2 illustrates this natural progression of our team effort in developing labs. Although the terminology is not formalized, we define coordination as teamwork that does not involve content sharing other than agreeing to use the same set of independently developed material, i.e., textbook, external cases, etc. Cooperation describes teamwork where individually created content such as labs, lectures, and assignments are shared. However, the shared material is not altered without consent or authority of the original author. Collaboration is distinctly different than cooperation in the sense that the material is either co-created initially or the revision and improvement process yields a new lab that truly reflects group authorship.

Practice What We Preach: Serendipitously, our move to a true collaborative model has been greatly facilitated by Computer-mediated Communication and Collaboration (CMCC) technology, which is an important MIS topic. Systems such as Blackboard, Google Apps, wikis, and web conferencing tools provide our teaching team with a two-pronged benefit. First, the technology facilitates a high level of collaboration in developing lab material. Second, using the technology internally provides our MIS faculty a shared experience that prepares us to teach about CMCC concepts and helps us encourage students to use CMCC tools throughout the course.

CMCC enables a rich type of collaboration where a broad group of stakeholders develops ideas and products that are 'greater than the sum of the parts.' It is only natural for a course that teaches these principles to use them in the course development process.

Our goal is to foster creativity and encourage the synergies that emerge when we integrate diverse skill sets that our colleagues bring to the course. We feel that CMCC tools and technologies are the key ingredient in helping us achieve this goal. Specifically, CMCC facilitates *stigmergic collaboration* where our MIS faculty can work together without a central authority, similar to how social insects such as ants, bees and termites collaborate to find food and to build nests. Pierre-Paul Grassé coined the term stigmergic collaboration in 1959 to describe emergent behavior in termites where activities of other termites trigger complex nest-building actions (Elliot 2006; Moisil, et al. 2008).

In our case, the "nest" is the Blackboard site along with Google Docs shared by instructors. Similar to other empowered team structures, leadership shifts between team members, depending on the task. The team is highly experimental; new approaches are tested and incorporated quickly as new strategies for lab development are discovered. By using collaborative tools and technology, instructors can effectively work on tasks for their own course sections that collectively benefit current and future MIS instructors. The students are using a more basic model of collaboration; the stigmergic approach is limited to the faculty team teaching our MIS course.

2. WHAT WE HAVE ACHIEVED: OUR CURRENT PARADIGM

We introduce a new framework for building a MIS course that capitalizes on the benefits of shared lab activities that are delivered electronically and developed collaboratively using the latest CMCC tools and applications. While computer mediated communication is an important underlying theme, our MIS course covers a broad range of foundational topics found in the leading textbooks (Kroenke, 2008; O'Brien, 2008). Hands-on lab activities drive the content of the course. While individual instructors can develop their own lectures and homework assignments, our sequence of 11 lab activities provide a common experience for all students taking the course. Instructors have ownership of their lectures and emphasize different topics, but all instructors teaching the course own the lab activities collectively. Collaboration pervades all aspects of the course design. In planning for and setting up systems for others to collaborate, we have nurtured a form of meta-collaboration, where instructors work together on new ways to foster and improve collaboration. This focus on collaboration has driven our instructors to build an online-shared repository of course material, to propose new strategies for coordinating and cooperating, and to explore new collaborative course-related projects that have led to conference presentations and journal publications.

A. Blackboard: More than Just a Learning Management System

In order for faculty colleagues to share ideas and institutionalize best practices, the MIS teaching team of seven full-time faculty members maintains a shared Blackboard course as a repository for all course materials (see Figure 3a). Blackboard is not only used to disseminate files and documents to students in labs, it is also used among instructors to manage the editing process of our labs. For each lab, we have created Blackboard content areas that store related documents and files including a Suggestions and Errata sub-section where instructors can describe recently encountered problems or elaborate on future improvements. Figure 3c shows the original shared documents and the Suggestions and Errata sub-section. Other instructors who have yet to deliver the lab to their respective lab section can make adjustments to anticipate reported problems. Since the documents and files are delivered electronically, this process allows for real-time editing where corrections can immediately benefit other instructors.

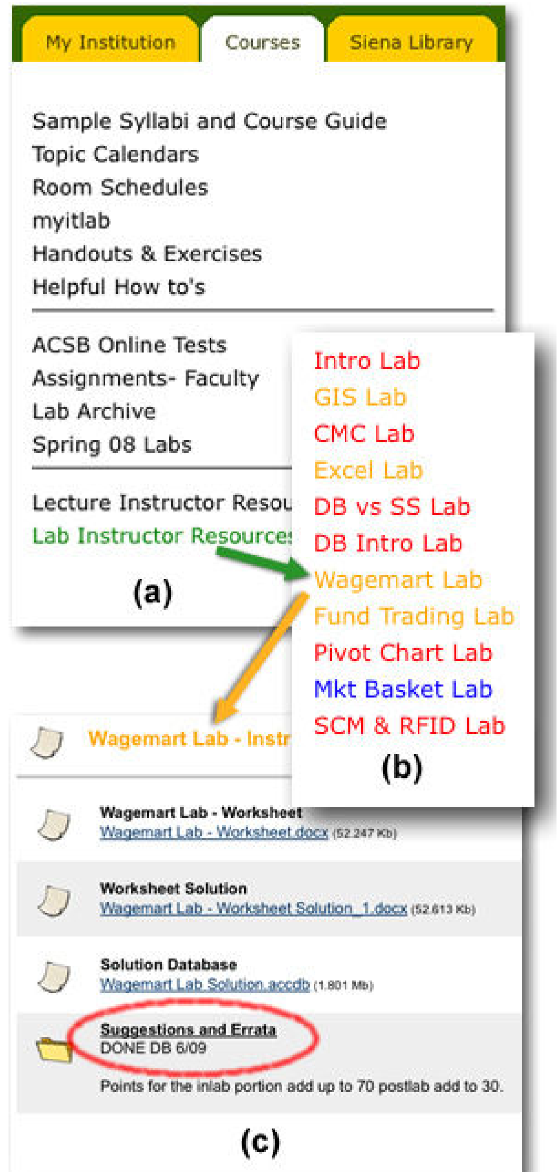

Figure 3: Shared Blackboard Material

At the end of each semester, we color the titles of labs with unresolved problems red to indicate that the lab needs to be edited. Figure 3b shows more of our shared MIS course material on Blackboard including the colored lab titles. Any instructor can volunteer to be an editor for a "red" lab. Once an editor adopts a lab, he or she changes the title font color to orange, indicating that the lab is actively being edited. Whether an instructor is improving a lab or correcting a problem, the lab editor must solicit a volunteer reviewer by emailing the entire MIS team. The editor and reviewer can discuss changes in detail without burdening the entire team. After the editor makes the changes to the lab, the reviewer evaluates the changes to the lab. Once the editor and reviewer reach agreement, the color of the lab title is changed to blue. The editor and reviewer then request a final reviewer to perform a "run through" of the lab in its entirety. The final reviewer does not evaluate the changes specifically but rather ensures that the editing process did not introduce new problems or disrupt of flow of the lab. Once all issues have been resolved the lab color will be changed to green indicating that the lab is ready for our students. Figure 4 shows the color-coding process used for both minor editing and major lab revisions. While the creation process of our labs has varied over the years, the editing process below is also applicable to new lab creation.

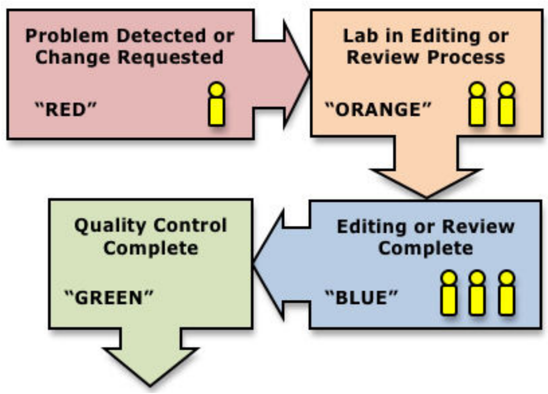

Figure 4: Editing Process

This process allows any instructor to edit a lab by simply proposing changes to the MIS team and soliciting a reviewer. Our goal is to create a process to promote collaboration where labs must be edited collaboratively (by at least three instructors), but the overhead of full team consensus is not required to begin the process. If the original author is concerned about a proposed change, they have the opportunity to be the reviewer. This process allows improvements to be made by small, dynamically forming groups, while preserving lines of communication with the broader MIS team. Using this workflow process, our labs have evolved into collaborative creations where it is difficult to identify the work of the original author. At any point in time an instructor can initiate changes and improvements to the labs without the need to secure permission from a central authority or the original author. This stigmergic collaborative model removes barriers that might prevent new instructors from making contributions.

B. Our CMCC Lab: Lab Imitating Life

We recently adopted a new textbook (Kroenke, 2008) that focuses on CMCC concepts. In conjunction with teaching technological and social aspects of CMCC in lecture, we developed a new lab to give students practical CMCC experience. Most students in the "Facebook generation" instantly grasp the concepts and are motivated to explore CMCC from a business perspective. We do not limit our collaboration expectations to the CMCC lab, but extend it throughout the semester for a variety of projects. Students are required to use Google Docs and wikis for a group research presentation, and Google Calendars to schedule appointments with instructors and classmates. Each student research group has at least five students, making primitive collaborative methods such as e-mail document coordination and piecemeal work impractical.

CMCC is a core technology transforming the way businesses and organizations operate. Our CMCC lab introduces the basics of computer-mediated communication and discusses the evolving advantages and limitations of various communication channels. We discuss a timely case study about using an information system to improve business processes at a hospital. The lab activity emphasizes the importance of people, processes and technology by exploring how an information system can improve workflow and patient care. We demonstrate chat systems, message boards, wikis, shared calendars and shared drawing systems, and discuss cloud computing and software-as-a-service concepts. Students form virtual workgroups using Google Docs to compose shared responses to the case study. In the post-lab, teams of students create a shared Google Presentation to design a collaboration plan that links workgroups across gender, culture and time zones. In this manner, students can learn to design collaboration strategies. By using the same CMCC tools that students use, we "practice what we preach" while creating an environment that facilitates communication between students and faculty.

C. Our Labs: The Result of Collaboration

Lab structure: We use a triad framework for most of our labs, combining theory, technology, and cases (Figure 5). Presenting a business problem using technology such as Geographic Information Systems, Excel, Access, and Radio Frequency Identification (RFID) readers reinforces material (theory) from the text. Using software and technology in addition to the Microsoft Office suite adds depth and variety to the course -- a "proof of concept" that other technologies can be used in a general MIS course. Background readings and case studies are used to demonstrate practical applications of theory. There is a post-lab component where students synthesize what they have learned from the pre-lab case, text and the fast-paced lab experience. Thus, there is an extensive writing component in the course that allows students to reflect on larger issues and hone their written communications skills. Students at times will be asked to collaborate for the pre-lab exercises and often are required to collaborate during lab. With the exception of the CMCC lab, no collaboration is allowed for the post-lab component.

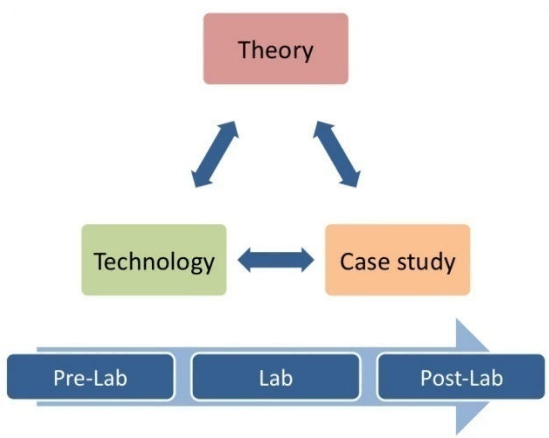

Figure 5: Lab Structure

To reduce paper costs we use dual monitors in lab allowing students to view lab instructions on the secondary monitor while using the primary monitor to work on the lab task. Our current lab sequence is described in the appendix. The labs demonstrate a unique blend of topics that reflects the diverse expertise of the MIS team and embodies the benefits of extensive collaboration.

D. The Effects and Benefits of Collaboration

Effects on Faculty: Our collaborative efforts are twofold: we incorporate collaboration tools in the course to teach our students how to use them, and we use a collaborative model within our department for course development and supporting new faculty. In addition to Blackboard, we use Google Apps as our main tool set for collaborating on new ideas and new labs. Google Docs enables a richer form of collaboration where documents can be edited online in an asynchronous manner while preserving a detailed revision history, which helps busy faculty co-author material effectively. Google Calendars greatly facilitates the process of scheduling meetings, which becomes more and more difficult as the number of collaborators increases. We actively collect and share articles and cases about new developments and challenges related to CMCC. All of these factors have increased our cohesion as teaching faculty and have enabled us to achieve a stigmergic style of collaboration. Through this collaborative paradigm two of our labs have been expanded into new courses, Introduction to GIS, and Introduction to CMCC.

Effects on Students: We ask our students to use Google Calendar to schedule meetings with their instructor and their classmates, Google Docs to develop group responses, and Google Presentations to collaboratively present group results throughout the semester. For their research experience, students are required to use Google Sites (wiki) to collaborate on their research and to present their findings. We have discovered how important it is for students to learn techniques for collaboration, as this will be a critical skill in the marketplace. Working in teams creates an enhanced sense of community and ownership in projects. This approach naturally leads to many iteration and feedback cycles among team members to continually refine and add to the work in progress. Unlike using traditional methods of collaboration, instructors are able to easily measure individual contributions by viewing revision histories. Peer pressure is brought to bear on team members that do not contribute to the project. Although team members have to contain their egos as others change and add to their ideas, the over-all quality of the entire project can be elevated through the use of CMCC tools.

3. WHERE WE ARE HEADED

Gender: One of the most interesting and immediate implications of incorporating CMCC in the course is the effect of gender for motivation and student success. Recent research (Blocher 2008) indicates that communication styles differ between men and women. Awareness of these differences can lead to better outcomes in using CMCC tools.

Women tend to use CMCC to maintain relationships and for social networking. Women also tend to be more inclusive of others' opinions, and more often employ a consensus-building decision-making style. Women's language style tends to be rich and complex, using voice tone, facial expressions, eye contact, and gestures that add nuance to communication but can be hampered by text-only media. Men tend to be more direct in their interactions, often with underlying competitiveness, leading to a task-oriented style that can result in making decisions quickly. Men tend to use fewer non-verbal cues in their communications style, with a directness and clarity that carries over well, even in text-only media.

Since cheating is a major problem in programming courses, computer science courses tend to discourage collaboration of any kind. This lack of collaboration among peers may be a significant contributing factor in why women tend to dislike programming courses. Individual analysis and programming tasks have minimal social aspects; thus students can easily become disconnected from the engaging real-world problems and solutions that produce beneficial outcomes for society. By making social interaction a focus of labs and projects, our MIS course reinforces that "soft skills" like collaboration are valued in analysis and problem solving.

We are fortunate to have a balance of men and women teaching the course, so there are role models for our female students. It has been our experience that women prefer working in groups. There are opportunities to work in groups during lab, and also for a major group presentation using a wiki. Often one of the group presentation topics is about women in business or IT. Our CMCC lab discusses differences in gender communications styles, and students create a thematic map in the GIS lab that shows the distribution of gender in the US by state. More research is needed in this area, and we hope to gather data about differences in learning styles between men and women for a future publication and incorporate what we discover into our classes. We hypothesize that the collaborative, interpersonal nature of the course indicates that women will be more motivated by this course than most CS courses.

Broader Collaboration & Challenges: As our circle of stakeholders expands, we have experienced a significant increase in the synergy, energy, and excitement in our team. The labs we have produced collaboratively transcend anything we could have achieved individually. Our focus for the future is to involve a larger group of collaborators including faculty from other departments and institutions and to improve the delivery of our labs. While Google Docs provides outstanding collaboration capabilities, it does not include the robust formatting tools that Word has. In turn, Word provides minimal support for concurrent editing, which decreases the speed and effectiveness of collaborative editing. We often use Google Docs to collaborate on ideas for our work, including this paper, and then transfer it to Word for final professional formatting. A limitation with this approach is that once the document is in the formatting phase, only one colleague can edit and work on the document at a time. We are exploring the use of file sharing programs such as Dropbox (http://www.getdropbox.com/), Synchroedit (http://www.synchroedit.com/), Microsoft Groove or SharePoint as possible systems to improve our collaborative efforts.

Collaboration with Students: To provide a more student-centered experience we have started to employ students to help review, refine and develop course material in innovative ways. During the summer 2009, we hired a diverse group of students to review some of our labs and to create a student-focused pre-lab training tutorial. The students are using Skype for videoconferencing and Camtasia to record video tutorials. In the process, the students are providing feedback to us on how we can make the labs more interesting and easier to understand.

The students have provided insightful comments and valuable suggestions for lab improvements and we are considering expanding on this model in subsequent summers.

In the spring of 2009, a former student from our MIS class, Katie Harrigan, began working with our MIS team as a research/teaching assistant to develop a one-credit CMCC course. The course includes lab activities that utilize applications such as OneNote, WebEx, SharePoint, Skype and Second Life. Social networking is something our students are intimately familiar with and they have great insights in how to use this technology in courses. Having students design course materials is proving to be an outstanding way to incorporate student-centered learning into our pedagogy and we look to expand these efforts in the future.

Social Networking: We are looking at emerging Web 2.0 technologies and models of social networking that will further engage our students. In the summer of 2009, we will be installing the Blackboard building block (add-on) called Learning Objects, which will enhance the collaborative experience for our students by offering wikis, blogs, podcasts, and ePortfolios. These tools will improve our ability to elicit critical feedback from our students about our labs in a natural way for them to express their ideas.

Awareness of Globalization: We plan to weave into our course relevant issues surrounding globalization and outsourcing. When our students graduate, they will be using CMCC tools extensively as members of virtual teams that may include international colleagues. Companies will need to train and deploy their staff in new ways to maintain flexibility and competitiveness. This includes effective use of technology for supporting the collaboration of work processes and increasing cultural awareness to enhance team building across geographic and organizational boundaries (Yoder, Eccarius-Kelly 2006). Strong and polished communication skills have always been essential to professional success. With this new paradigm of conducting business and communicating via computer, the importance of knowing how to use CMCC tools to communicate effectively has never been more important.

4. CONCLUSION

MIS is a great course to develop collaboratively because of its interdisciplinary nature. MIS is rooted in the underlying technology (information systems), the automation of problem solving (computer science), and real business problems (accounting, finance, marketing, etc.). It can be challenging to collaborate with a broad group of stakeholders with different backgrounds. Using CMCC tools not only facilitates the collaboration necessary to build an outstanding interdisciplinary MIS course, but it also provides instructors with the motivation to encourage students to use the same tools. Thus, students can more easily become part of the course development process by noting errors and suggesting improvements. When students and course developers use the same CMCC tools, the processes of improving and delivering labs can be completely connected. This paradigm for teaching MIS brings together the expertise of a large group of stakeholders including students to create an evolving, diverse and exciting course. Our primary motivation is creating an MIS course that will prepare students for evolving and emerging business careers. We believe communicating and collaborating effectively with technology is not just a passing trend that appeals to students and faculty, but is an essential job and life skill that naturally fits into the goals of an MIS course.

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APPENDIX

1. Introductory Lab: Lab policies and procedures are introduced including an overview of the CMCC tools used throughout the semester. The advantages of using a network drive for storing lab work are explained, and eventually contrasted in the CMCC lab where "cloud computing" is discussed. Students get to know each other by posting their picture and profile on a Blackboard discussion forum. Students configure their Google Homepage and share a Google Doc in preparation for the CMCC lab and group research project.

2. GIS and Spatial Analysis: Geographic Information Systems (GIS) are a vital tool for visualizing, communicating, and reasoning with geographic data and understanding spatial patterns. This lab introduces students to spatial analysis by studying a 9/11 World Trade Center case (Dawes, et al. 2004) and using the MapInfo GIS to create a list of the closest fire departments (Figure 6). Students use a Blackboard discussion forum to collaboratively explore and analyze the "attributes of information" such as accuracy, timeliness, and relevance that pertain to the case.

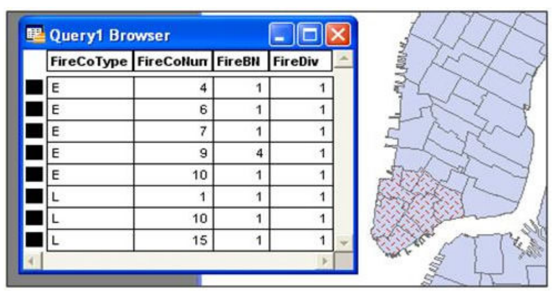

Figure 6: GIS Report and Map

3. CMCC: See section 2.B in the paper.

4. Spreadsheets: This lab provides an Excel refresher for students to expand upon and practice their Excel skills. While Excel proficiency is a prerequisite, the skill level of our students can vary greatly and it is imperative that our students have a strong fundamental knowledge of spreadsheets before starting the next seven labs.

5. Excel vs. Access and User Interfaces: We use a hands-on experience to demonstrate common spreadsheet misuses. We explore data integrity and redundancy issues as well as basic normalization concepts to clearly show why data should be stored and queried using a database. We explain database management systems and demonstrate the use of forms and user interfaces to utilize the full power of database systems. In comparing spreadsheets and databases, fundamental concepts of user interface design and human-computer interaction are presented and discussed.

6. Databases: Building upon their initial exposure to Access, students create their own human resources database for employee scheduling by creating tables, importing spreadsheet data, and establishing relationships. This lab reinforces the concepts of data integrity and data modeling covered in the previous lab.

7. Decision Support Systems (DSS) I: Using the human resources database from the previous lab, students use advanced query techniques to examine three different strategies for cutting labor costs. Students are introduced to key DSS concepts such as analytical scenario modeling and what-if analysis in the context of realistic data. At the core, the lab demonstrates the power of database systems to transform raw data directly into critical information used for decision-making.

8. DSS II – Fund Trading: Extending on the DSS concepts of the previous lab, students use both graphical and database tools to pick optimal dates to buy and sell mutual funds (Figure 7). Students are introduced to additional query techniques used in decision-making as well as the concepts of optimization analysis and heuristics.

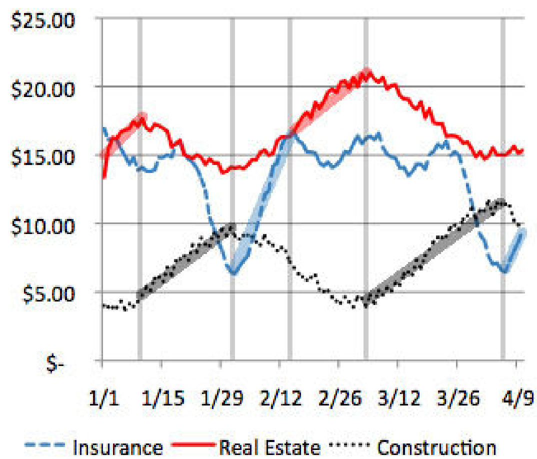

Figure 7: Mutual Fund Chart

9. Pivot Charts: Bringing together the concepts of Online Analytical Processing and Machine Learning, students try to predict an outcome ("Play" or "Not Play") based on attributes such as temperature, humidity, weather, mood, etc. Excel pivot charts (Figure 8) allow students to visualize multidimensional training data to discover logical rules for predicting the dependent variable (“Play”). Along the way, students are introduced to drill-down analysis and conditional logic.

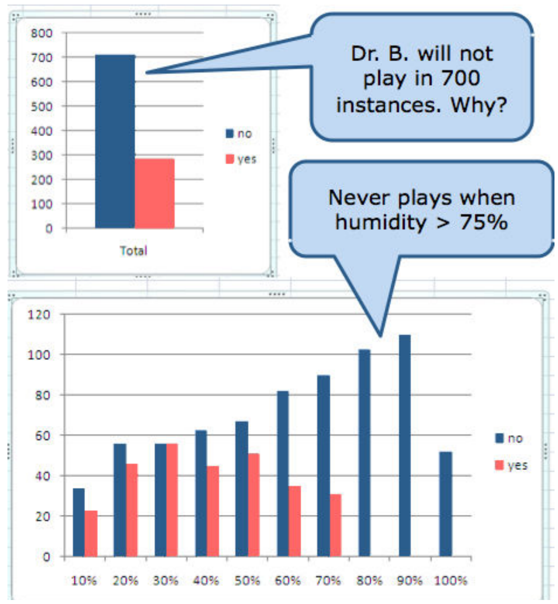

Figure 8: Pivot Chart

10. Market Basket Analysis: The basics of data mining and market basket analysis are covered in the pre-lab and lecture. Students use a database and spreadsheets to calculate support and confidence measures to determine association rules of items purchased together using a real-world case of a farmer's vegetable stand. Students are led to discover the a-priori rule and its effect on computational efficiency for larger sets of items.

11. Supply Chain Management (SCM) and RFID: An overview of SCM concepts and RFID technologies are presented and demonstrated using RFID readers and tags. Students study classic SCM/RFID cases relating to Wal-Mart and Procter & Gamble. The "bullwhip effect" is demonstrated by playing a simplified "Beer Game" as a case for managing a supply chain. HTML and XML are contrasted, and a business document is validated using an XML schema.