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A Case Study of Offshore Development across IS Courses: Lessons Learned from a Global Student Project

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Abstract:

As global, virtual teams become more prevalent in the workplace, it is imperative that we, as educators, prepare IS students for this trend. Offshoring, virtual teams, and globalization are themes often discussed in the classroom, but students rarely experience these concepts. This paper is a case study of three globally distributed universities worked together on a project in order to equip students with knowledge and experience about these trends in an IS context. In spring 2008, students from a technical management course in the USA, a project development course in the USA, and a programming course in India worked in teams to propose, design, develop, and test software prototypes. The case study in this paper presents the three phases of this project: 1) planning, 2) execution, and 3) reflection. The planning phase includes the identification of teams, tasks, and technology. The execution phase includes challenges and successes that can be avoided or enhanced in future iterations. Finally, the reflection phase presents lessons learned from the student and instructor perspective as well as perceived value of the project across students, instructors, and industry representatives. In general, students perceived this project to be quite valuable for their future careers and successful as a learning experience, but the project was not without its challenges throughout.

Keywords: global offshoring, virtual teams, collaboration, teaching case study, education

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I. INTRODUCTION

A report from the Gartner Group suggested that in 2008, virtual teams would account for 60 percent of offshore work arrangements [Bell 2005]. This suggests that professionals are increasingly finding themselves as members of virtual teams, consisting of geographically dispersed team members working together through the use of technology [Lipnack and Stamps 1997; Robey et al. 2000; Townsend et al. 1998]. Based on this, it is necessary for students, instructors, and practitioners to understand the nature of these relationships, to determine key factors that impact virtual teams in an offshore context, and to identify how these factors influence team outcomes.

Given the changes that are occurring in today's global workplace, students should be encouraged to explore issues associated with virtual teams and offshoring by experiencing this environment firsthand. This paper presents a case study of one such project that took place in spring 2008. The project was designed to be consistent with other virtual team projects where students complete assigned tasks through technology mediation [e.g., Adya et al. 2008; Jarvenpaa and Leidner 1998; Tarmizi et al. 2007]. This type of exercise is becoming more common in the classroom [e.g., Adya et al. 2008]; however, this project was unique from some other virtual team exercises. For this project, seven teams were formed with students from three internationally distributed universities working together. The students collaborated over an eight-week period to propose, design, and develop unique information systems prototypes. Students from each university were taking very different types of courses and the students from each university played different roles within the team. Though the project was structured to some degree, the manner by which outcomes were achieved was largely dictated by the students. This enabled the students to explore relationships, activities, and technology in order to best suit the needs of their team. The project supported both solution scheme multiplicity [Campbell 1986] and tailorable technologies [Germonprez et al. 2007], enabling the students to negotiate across internationally distributed campuses and experiment with social and technical designs.

This paper provides detail into the eight-week virtual, offshore project experience and is organized according to the three phases of the project: 1) planning, 2) execution, and 3) reflection. The planning phase is presented in detail to allow it to be recreated in a classroom setting and provides details on how the project was pedagogically designed and implemented. The execution phase is presented through examples regarding what went well and what did not by identifying both project successes and challenges that arose during the project. Finally, a reflection phase is provided, including lessons learned from the perspectives of students, instructors, and practitioners as well as an assessment of the value of this particular project. Specific details of how the students and instructors participated in the project are provided in hopes that fellow academics could replicate and improve the project.

II. PLANNING PHASE

In organizing this project, courses were chosen that would provide a richness of student skills across three geographically distributed universities. The students at the first university (U1:USA) were taking a technology management course at a midwestern United States university. The course focused on management challenges and opportunities in a digital world. Topics included the role of information systems in globalization and developing a competitive advantage. This course also examined other management activities in an IS context, such as developing strategy, planning, controlling, and leading and motivating employees. The class used discussion, case studies, and student projects to help students learn how to apply management concepts and frameworks in different contexts.

Students from the second university (U2:USA) were from a project development course at another midwestern United States university. The course focused on testing, identification, and administration of information systems projects. In particular, the course integrated design, development, and implementation across a variety of team projects. Students deconstructed large scale data models, ran systems testing projects, and investigated entrepreneurial project development. The class was designed to encourage students to explore self-motivated, unstructured work in the context of information systems design and development.

The third university (U3:India) involved programming students from north-central India. These students were approximately halfway through their undergraduate program and had experience with a broad range of programming languages. This team of students was hand-picked for this project based on their performance in their academic program.

An instructor from each university and an overall project coordinator administered the virtual, offshore project. In order for the instructor planning to take place, more than 100 e-mails were exchanged and numerous conversations via Skype were completed prior to the start of the project to identify project goals, develop documentation for the students, discuss the timing of the project, and share any questions or concerns about the project. The high volume of communication was essentially to determine the structure and content of the supporting course instructions and assignments (see Appendix A for the key document that was developed during the planning phase).

Team Assignment

Teams were formed with eight-to-nine students each, ranging from two-to-four students per university. The size and complexity of the project suggested a need to carefully consider how teams were assigned. Students were first assigned to a team within their university and then assigned to work with teams at the other two universities. A questionnaire was administered to the students based on previous research and containing questions about the students' strengths and weaknesses in relation to technology and teamwork [Rizzo et al. 1970; Zigurs and Khazanchi 2008]. The project coordinator then analyzed the data and assigned the students into their respective teams. The assignment of members to teams was a manual process, to ensure a diverse set of skills across the teams (leadership, technical abilities, and project work experience). Specifically, teams were designed to have a balance of technology skills, team work skills (specifically virtual team work) and task skills (global offshore development).

The students participating in the project from U1:USA also had another component to team assignment and organization. Because the deliverables for this university were associated with management, it was impractical to have a team of three or four "managers." Therefore, based on the students' responses to the questionnaire, they were assigned the roles of project manager, internal auditor, project sponsor, or user. These students were encouraged to adopt the roles within the project team and had specific assignments and deliverables to complete based on their assigned role. In U1:USA teams in which there were only three students, the user role was not assigned.

Project Details

Each course from the three universities had a different role within their respective curriculums. As a result, the duties were tailored based on the goals and objectives for each class and university. Figure 1 provides a high-level overview of the primary duties for each university.

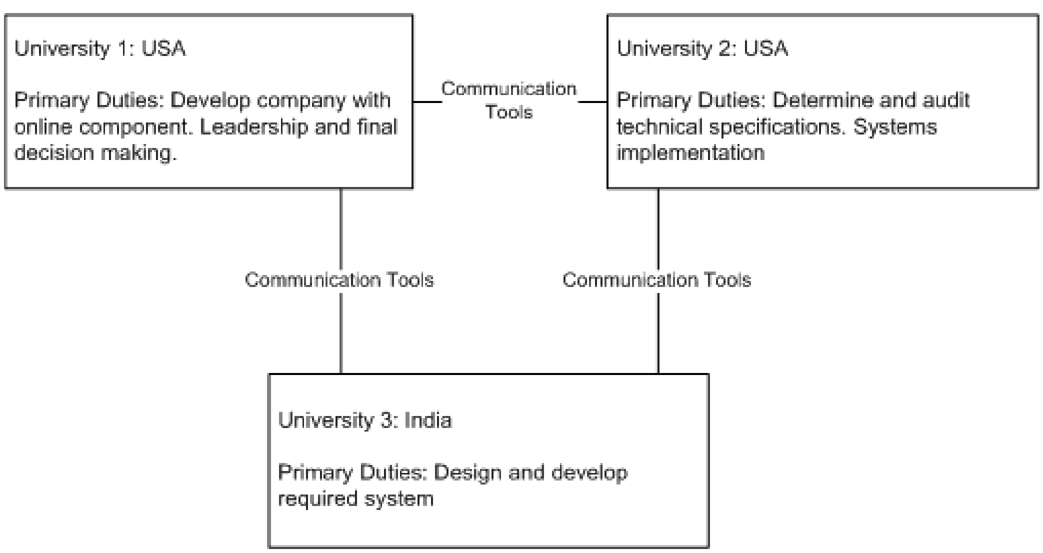

Figure 1. General Relationship among the Universities

The students from each university had different sets of deliverables that were related to specific goals and objectives of each course. At U1:USA, the students were responsible for the management of the project; therefore, the first assignment included specifying a new business or identifying an improvement for an existing business and then specifying an information system that would accomplish an organizational objective for the business. The system had to include a transaction component with a moderate level of data complexity as defined by the instructors.

Student teams were provided with three examples; however the identification of an IT project was open. One of the examples provided to students was as follows:

> *Web Service Publishing:* *Your organization needs a way of managing and publishing Web services. In the application, new Web service developers would be able to:*
>
> *a. Download guidelines for how to build and publish Web services;*
> *b. Identify one of three high-level classifications to which to submit their Web service and associated WSDL;*
> *c. Mark their Web service to that classification and upload their service.*
>
> *Once the Web service is uploaded, the application will notify an auditor of the Web services. This notification will tell the auditor that a new service has been uploaded and provide the location of the Web service. The auditor will then login to the application and evaluate (accept or reject) the Web service prior to making it available throughout the entire company. Following an auditor's approval, the service will become available throughout the company such that other developers can access the Web service and use it in their own applications.*

Once the idea for the information system was approved, the U1:USA students were responsible for organizing and monitoring the progress of team. The U1:USA students worked with the entire team to specify deadlines and help manage the design and development process. As the project progressed they were also responsible for examining the system, providing change requests, and prioritizing functionality.

The U2:USA group had the role of system designers and testers. After U1:USA identified an information system to be developed, U2:USA had the role of properly scoping the project and modeling the proposed system. U2:USA delivered the design documents, including Entity Relationship Diagrams (ERDs) and Unified Modeling Language (UML) documentation, to U3:India and answered any questions about the design and development of the system. Once the system was developed, U2:USA implemented and tested the system using a variety of code and quality assurance metrics[1] and presented the results to both U1:USA and U3:India. U2:USA and U1:USA worked together to issue any change requests for the second iterations of systems development.

U3:India served as the project developers. They provided technical expertise and guidance on the choice of platform, technology, and feasibility of the system as during the proposal of the system by U1:USA and modeling of the system by U2:USA. After U2:USA completed the modeling, U3:India received a "work order" for a system that needed to be developed. U3:India completed a prototype of the system and share it with U2:USA to implement and test. In addition, U3:India were responsible for completing a second round of development based on change requests made by U1:USA and U2:USA. Table 1 provides a summary of the process.

Table 1. Team Project Process

U1:USA Process	U2:USA Process	U3:India Process
1. Develop a new business or improve upon an existing business.	1. Receive an "order" from the U1:USA students, examine the complexity of the project and work use cases that represent the flow of the system.	1. Provide technical expertise and guidance on the choice of technology and feasibility of the proposed system.
2. Propose an online system that accomplishes an organizational objective for this business.	2. Work with U1:USA to model the proposed system.	2. Receive a "work order" from U1:USA and U2:USA for systems design and development.
3. Monitor, control, and manage the design and development process.	3. Provide modeling documents to U3:India.	3. Develop a prototype for the U1:USA and U2:USA students.
4. Pilot the system through the use cases with test users.	4. Implement and test the system upon arrival from U3:India.	4. Respond to change requests and create an updated prototype of the proposed system.
5. Report on the progress of the project and final deliverables.	5. Pilot the system through the use cases and with U1:USA.	

[1] Source Monitor (http://www.campwoodsw.com/sourcemonitor.html);
Microsoft FXCop (http://msdn.microsoft.com/en-us/library/bb429476(VS.80).aspx)

The various steps in the virtual, offshore development project included several stages of deliverables. For example, the first deliverable for the management portion of the team (U1:USA) specified an organization and a proposed information system. The technical writing portion of the team (U2:USA) evaluated this decision and provided the instructions and specifications for the programming portion of each team (U3:India). Table 2 shows the full list of student deliverables for each team. See Appendix A for more detailed documentation provided to the students about the project, team duties, and deliverables.

Table 2. Team Project Deliverables

Week	U1:USA Deliverables	U2:USA Deliverables	U3:India Deliverables
1	• Business idea and technology solution document	• Business idea and feasibility evaluation document	• None
2	• Receipt of business idea evaluation • Negotiate changes to business idea	• Negotiate changes to business idea • Modeling documentation • Deliver modeling and narrative of business idea to U3:India	• Begin developing code based on modeling documentation
3	• Receive prototype from U3:India • Recommend changes based on project specifications and changes • Individual Status Report • Team Status Report • Peer Evaluation	• Receive prototype from U3:India • Recommend changes based on project specifications and changes • Team Status Report • Peer Evaluation	• Refine and deliver first prototype to U1:USA and U2:USA • Receive recommended changes from U1:USA and U2:USA • Peer Evaluation
4	• Receive second prototype from U3:India • Recommend change requests and/or prioritize functionality not yet developed based on initial system specifications	• Receive second prototype from U3:India • Recommend change requests and/or prioritize functionality not yet developed based on the initial system specifications • Individual Status Report	• Refine and deliver second prototype to U1:USA and U2:USA
5	• Receive final prototype from U3:India	• Receive final prototype from U3:India • Team Final Report	• Refine and deliver final prototype to U1:USA and U2:USA • Peer Evaluation
6	• Final prototype testing and implementation • Individual Reflection Paper • Team Status Report • Peer Evaluation	• Final prototype testing and implementation • Individual Reflection Paper	• Final presentation to U3:India instructor
7	• Final presentation to U1:USA instructor	• Final presentation to U2:USA instructor • Peer Evaluation	• None
8	• Final presentation to U1:USA instructor	• Final presentation to U2:USA instructor	• None

One recurring deliverable was a peer evaluation. The same peer evaluation worksheet was to be completed across all three universities both at the midpoint of the project and at the completion of the project. With the evaluation, students were to evaluate each member within their team from their own university. They also were asked to rate the entire team from the other universities. The peer evaluation served as a tool to help the instructors identify any problems, miscommunications, or issues that may be affecting the team.

Additionally, team status reports and individual reflections were required at U1:USA and U2:USA. These papers provided the instructors with a window into the project to evaluate how well the students thought the project was proceeding. The status reports gauged two primary items: 1) How the students were progressing interpersonally in the group; and 2) How the students were progressing technically toward a final system. The team status reports were written separately by students at each of the universities and evaluated subjectively by the respective instructors. An example team status report by students at U2:USA is available in Appendix B.

Finally, design and development documents were to be exchanged during the project. These included ERD, UML diagrams, and metrics reports. These were to be evaluated on their level of detail and potential to express the required level of detail necessary for system development and refinement.

Communication Tools

A communication technology was chosen that offered a single point of communication for the team members to allow instructors to observe and evaluate students' work and communication during the project. If students were allowed to create their own communication environments (i.e., e-mail and Google Docs[2]), observation would have been difficult, if not impossible. At the same time, a goal was to provide students with an environment that was not over-specified so that the students could tailor their use of the tool to suit the needs of the team without leaving the bounds of the selected communication tool.

Teams met for the first time in a Collanos Workspace[3], software that allows team members to share documents, send messages, and chat. This technology provided teams with a "one-stop shop" for all communication needs. The students were able to use the various capabilities within the technology to complete their deliverables. How the communication tool was used was not specified by the instructors; however, training videos[4] accompanied the project to demonstrate some of the useful features of the communication tool. Students were required to submit their deliverables via Collanos to ensure they would actually use and develop some familiarity with the tool.

Overall, the planning phase required considerable time and negotiation between the instructors to coordinate anticipated virtual, offshore activities. Following the planning phase, the instructors moved into the execution phase of the project.

III. EXECUTION PHASE

This section presents the execution phase with examples of challenges and successes during the project. Throughout the project, the execution phase stayed true to the spirit of the planning phase, however, difficulties arose. While every project cannot be explored in depth, exemplar cases are used to represent where the execution phase required intervention, did not achieve the desired team effect, and finally where the project was executed as planned. In the following descriptions, challenges and successes are largely defined by team members being able to identify issues and communicate them well. While a finished, working prototype may be a rewarding goal; it only represents an artifact and not necessarily the experiential process in which team members engaged. What follows is a practical description of events during the project. A richer, reflective analysis is provided later in the paper that represents what was learned from both the planning and execution phases.

At the beginning of the virtual, offshore project, the team projects proposed by the U1:USA students were highly varied in complexity. At the conclusion of the project, the quality of the end products varied considerably as well. To provide an idea of the variety of projects and results, Table 3 outlines some of the organizations proposed, the information system requested, and the results for each of the project teams.

Execution Phase Challenges

During the eight-week project, several challenges arose across all teams with many relating to communication or communication technology. All challenges represented an opportunity to identify areas where the project can be improved in the future and were treated as learning experiences for both the students and the instructors. In the next subsections, we discuss challenges that occurred across all groups as well as challenges specific to a specific team but indicative of some of the other teams participating in the project.

Technology Challenges

Across all groups, communication technology was problematic. There were many challenges with Collanos, the selected communication technology. In the first three weeks of the project, it was clear that the majority of the students were unhappy with using Collanos Workspace for two reasons. First, all team members needed to be logged on at all times to share files with one another, due to the peer-to-peer design of the technology. This led to synchronizing issues because the participants were students who worked at various times of the day in various time zones and could not leave their computers connected at all hours. Second, Collanos required students to use a single computer for logon; however, many students needed the ability to log into the workspace at home, work, and school computer labs.

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[2] http://docs.google.com
[3] This tool is free to download from http://www.collanos.com.
[4] An example of a communication technology training video: http://www.youtube.com/watch?v=v-OFaW1rDI4

Table 3. Sample Projects Developed

Organization Description	Information System Proposed	Project Result
University Campus Security Office	Web-based system to support renewal of parking permits and ability to pay fines online	Three iterations of prototype development. System met the expectations of the project sponsor and satisfied a majority of the requirements. Only minor bugs and quality issues were identified by project sponsors.
University Library	Web-based system to enable patrons to view the location of a given book on a library map	Three iterations of prototype development. Sponsors believed system provided most of the functionality requested; however, sponsors identified several quality issues.
Restaurant Technology Firm	Information system to allow patrons at a restaurant to order food and beverages without speaking to a server.	Two iterations of prototype development. Major requirements for the system were developed, with some functionality lacking. Many quality issues were noted.
IS Outsourcing Marketplace	Web-based information system to allow clients to find programmers for a specific IS project	One iteration of non-functional code and one prototype was delivered. Key requirements were not developed and the quality of the overall project was deemed unacceptable by the project sponsors.
Educational Technology Firm	Web-based course management system used by students and instructors for both one-way and two-way synchronous and asynchronous communication	One iteration of prototype development. Most of the functionality requested was not completed or of poor quality.
Lawn Care Firm	Web-based system to bill customers for lawn services	Two iterations of prototype development. Most of the functionality requested was delivered; however, there were several quality issues noted by project sponsors.
Data Backup Service	Web-based system to enable customers to backup data to a third-party location	Two iterations of prototype development. Many functional requirements were achieved. Other requirements deemed as core to the project were not completed in the development of the system; the final product had a professional appearance.

As a result of these two issues, an intervention during the project was required to address the problem halfway through the project. Students were informed of a switch in technologies and that they would be moving to a Web-based communication system. This choice was made despite research that suggests switching technologies in the middle of a project is a poor idea due to the learning curve, rework and back up, and inevitable mistakes made during the transition [Nelson 2007]. While the instructors did not want to change the technology midstream, the communication issues that arose when using Collanos had to be overcome for the students to concentrate on the task at hand: designing and developing an information system in a virtual, offshore environment.

The new tool chosen, Huddle[5], is similar to the Collanos Workspace in that it offers a collaborative workspace for teams; however, unlike Collanos, which used use peer-to-peer technology, Huddle is an online tool and therefore can be accessed from any computer. Figure 2 is a screen shot of the Huddle workspace.

The feedback from the students suggested that many were satisfied with the change and importantly, it solved the technical deficiencies found in Collanos. Irrespective of the technology, the instructors had to focus on the task at hand: completion of the project. If one technology failed to support students in the achievement of that goal, a switch had to be made. In all, the selection of a communication technology proved an important aspect of the project as it was the primary workspace of the team members. If monitoring is not important, allowing students to build their own work environment (i.e. Google Docs and e-mail) may prove a better option.

Team Challenges

While the technology switch affected all students across all universities, some localized communication issues arose within specific teams. Presented here is one such challenged team that experienced difficulties in team level communications. While challenges were not identical across all teams, the following example illustrates some of the most evident issues across teams.

[5] This is an online tool found at http://www.huddle.net.

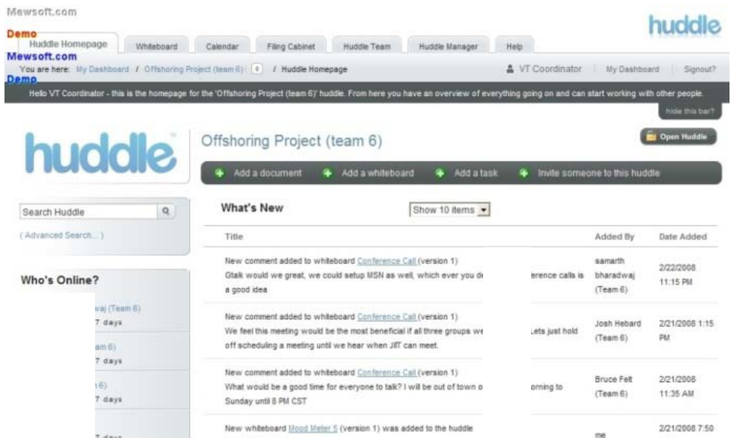

Figure 2. Example Huddle Workspace Screenshot

Challenged Project Overview. As shown in Table 3, one team wanted to create course management software for this project. They wanted an interactive medium for students and professors to communicate both synchronously and asynchronously throughout the semester. They realized the benefits of course management software such as Blackboard and WebCT, but wanted to include additional options such as instant messaging, support for interactive media, and the ability for students to post comments on lectures, readings, or other media posted on the site.

These initial requirements proposed by the students proved to be too complex and beyond the scope of an eight-week project. Students at U2:USA, along with their instructor, developed a design for the system to dramatically reduce the scope of the project. These scope changes were negotiated and agreed upon between U1:USA and U2:USA over the period of approximately one week.

Challenged Project Documentation and Communication. The team developed different types of documentation to design, develop, and manage activities of the team and rein in the scope of the project. Although this project was considered challenging, the team was able to develop and post the following types of documentation.

1. *Design Phase*: System Requirements; System Narrative; Entity Relationship Diagrams; Unified Modeling Language
2. *Development Phase*: Revised System Requirements; Entity Relationship Diagrams; Unified Modeling Language; Screen Mock-Ups
3. *Team Management*: Team Reports

The team used the Collanos and Huddle communication tools to submit more than 15 messages in the form of discussions and comments and approximately the same number of documents; however, the majority of these messages were from one team member at U2:USA. The communication from this individual was quite professional, but there was little response from U1:USA or U3:India via the communication tools. As a result, the documentation was largely communicated by a single member of U2:USA so the impact that any documentation had on providing team-level information of the evolving project was limited.

Challenged Project Final Deliverable. The system was never fully completed. The only prototype had no real user interface and did not even provide the most basic of functionality. The students at U1:USA that proposed the system were quite disappointed with the final result. In their final status report, these students stated:

> *The final product delivered to us meets hardly any of the requirements we had specified. Most importantly, it is not working or finished even by the most minimal of our standards.*

In spite of these difficulties, the project did allow students to work in an offshore, virtual team and it gave them exposure, albeit limited, to using modeling and documentation in the design and development of information systems. Even as a project proved challenging, some members were still able to identify positive movement toward a team-level deliverable:

> *We feel that if we could have gotten a few more development iterations in, we could have worked together to refine the prototype until its functionality matched its intended design.*

In summary, the project was initially over-scoped and several team members worked to rein in this problem; however, subsequent communication tailed off, resulting in a mixed understanding of the project during the design and development phase. Naturally, this mixed understanding resulted in a poor final deliverable. While these are normal systems development problems, all students were exposed, in some sense, to just how difficult communication is when compounded with geographical and temporal distance. A primary goal of this project was exactly this type of exposure. The planned framework provided the potential for a successful project. However, the execution was complicated due to a failure of team members to communicate with each other. As a result, only certain team members were able to gain value from the project, and only from a conceptual, not applied perspective.

Successes

During the project, there were noteworthy successes. One was the use of technology for metrics and quality assurance testing by U2:USA to provide feedback to U1:USA and U3:India about issues with the prototypes. Additionally, several teams were able to execute the project plan and identify problems during the project. As seen in the previous student example of the course management system, success is not defined by a system that meets *all* the originally proposed requirements and is implemented flawlessly. Success is defined by the team members communicating effectively to propose an information system and identify subsequent changes for the system as prototypes are developed. Presented following is a discussion of a technology success that impacted all teams as well as a more localized example of a successful project.

Technology Successes

Metrics and quality assurance (QA) testing proved valuable when communicating between the teams, acting as boundary objects by which team members could identify, interact, and affect change [Star 1996]. In particular, students determined alignment between proposed design documentation with the delivered prototype. The U2:USA students used testing tools to examine the prototypes delivered by U3:India and focused on testing code complexity. The testing tool generated reports that were exchanged between team members regarding the technical details of the prototype. A sample metric test is included in Table 4.

Table 4. Sample Metrics Test

Metric	Reported Value	Location of Max Value
Percent Comments	0.7	
Average Method Complexity	3.6	
Max Method Complexity	6	Default.fillgrid()
Average Methods/Class	5	
Max Methods/Class		
Average Statements/Method	10	
Max Statements/Method	18	Default.mattg()
Average Depth (Nesting)	2.09	
Max Depth (Nesting)	5	Default.BtnGo_Click1, Default.fillgrid()

Numerous freeware tools are available to test code to this level of detail, contingent on the application language used[6]. The metrics provided quantitative tools that showed precise areas of concern and success associated with the development of the system. The metrics were sent with the redesigned modeling documentation from the QA testing to improve second and third iterations of the system prototype.

Team Successes

While metrics testing proved a valuable boundary object for many teams, more localized success arose within specific teams. Presented here is one highly successful team. Similar to team challenges, team successes were not identical across all teams.

Successful Project Overview. One of the successful projects centered on an online file storage utility. The project was intended to provide a Web interface, user account creation, data upload, download, and viewing, and calculation of user space usage. The Web interface provided users the ability to login to the system or create an account if necessary. If users have to create an account they would fill in a web form with information about themselves. Users could identify files to be uploaded, but the actual files were not stored within the system. A few more weeks of development would have most likely resulted in a completed prototype. For the project, the team was able to iterate through three working prototypes of the system.

[6] http://en.wikipedia.org/wiki/List_of_tools_for_static_code_analysis

Successful Project Documentation and Communication. Project documentation was consistently used to design, develop, and manage the activities of the team. During the project, the team created and shared the following documentation:

1. *Design Phase*: Feasibility analysis; Entity Relationship Diagrams; Unified Modeling Language
2. *Development Phase*: Entity Relationship Diagrams; Unified Modeling Language; Code Metrics
3. *Team Management*: Team Reports; Project Timelines; Meeting Minutes

In all, documentation was used as intended throughout the project, in the support of understanding, explanation, and coordination of team activities. While the collection of documents appears similar to the "challenged project," the detail that was shared and commented on by *all team members* proved critical.

The team used the Collanos and Huddle communication tools at a reasonable rate, generating more than 20 messages (files, discussions, comments) during the project across all team members. More importantly, the messages generally contained a high level of detail such that information on the feasibility, scope, complexity, and status of the project was consistently available and commented on. Most importantly, the messages were posted and commented on by all team members.

The documentation and communication was what really identified this team project as successful. The team members were critical of each other's work, reflective toward the project documention, and able to identify problems with the project. In short, they worked well across geographical and temporal barriers per the project.

Successful Project Final Deliverable. As a result of the aforementioned successes, the team was able to iterate through several prototypes, working on both login forms and main system functionality. Figure 3 shows a sample screen shot of the 'create new account' page for the system.

Figure 3. Sample Screenshot of Successful Project

From a functionality perspective, the system was not perfect but it was sufficient. More than 1,000 lines of code were exchanged and modified between U3:India and U2:USA. The code was well written but implementation issues caused functional components to remain undeveloped. As a result, the team had to consider success based on more than just full functionality of the proposed system. U1:USA commented on the professional "look" of the prototype in their final status report.

> *The [U3:India] students were able to create an appealing website. They created an interface that would be appealing for potential customers. The design of the site meets the original expectations of our team.*

In summary, the project was communicated well between team members. Like the challenged project, students were exposed to how difficult communication is when compounded with geographical and temporal distance. However, this team worked to understand, not avoid, these complexities. The success of this project required significant time and effort of all involved, but the experience provided a valuable, applied opportunity for learning to work in a virtual, offshore environment.

III. REFLECTION PHASE

This project incorporated many issues that may be new to students such as course content, technology, virtual teamwork, and cross-cultural interactions; thus, strong pedagogical practices became crucial. All these issues have been shown to be affected by the inclusion of multi-cultural teams [Starke-Meyerring and Andrews 2006]. The structure of the project and its role in the goals of the course were clearly defined, and the timeframe and policies relating to the project were also explicit [Zhu et al., 2005]. The provided structure benefited teams through explicit definition of member roles, in hopes of smoothing the team formation process throughout the project [Grzeda et al. 2008]. The project itself consisted of highly interdependent tasks to help ensure that collaboration occurred by requiring participation of all team members to solve the given problem [Chen et al. 2008], and was relevant to the course. The project also included unstructured elements as well, such as the ability of students to be creative in their specification of the information system to be developed for the project. Students were responsible for identifying and articulating requirements that could be comprehended by others unfamiliar with the idea across the globe. The overall project task, containing both structured and unstructured elements, had many parallels with real world problems.

The data used to identify lessons learned was a collection of several sources, represented in the following list:

1. Weekly surveys that allowed students to submit comments regarding the project
2. Notes from Skype and e-mail conversations
3. Daily screen captures of all team communication environments
4. Group and team reflection papers
5. Direct participation and observation by the instructors as involved researchers

Each of these sources was used to understand how well the overall project progressed and how it can be improved in the future. When reflecting on this project, it was apparent that both students and instructors learned a great deal from this experience. Therefore, the discussion is organized in terms of the lessons learned by the students and the instructors. Following is a discussion of the perceived value of the project from students, instructors, and industry practitioners. Not all of these experiences are necessarily unique to this project. What this project provided was exposure to both specific and generalizable experiences when working on system design and development.

Student-Related Lessons Learned

As with any new endeavor, there were many situations that arose during the project that impacted the students. Several "best practices" were identified at the student level that will be incorporated in future iterations of this project and should be considered by instructors interested in performing similar projects in the future. These lessons are not exclusively those learned only by students but represent lessons learned on issues impacting the daily activities of students. Each lesson was constructed through interactions of the students and the instructors and the aforementioned data collection sources.

Requirements, code, and changes must be clearly documented.

Traditionally, students are given a set of criteria from an instructor that has to be met in order to successfully complete a task. In this project, students were able to define their own solution schemes in the development of a new information system. This may sound trivial but this project pushed students to understand the importance of properly specifying and communicating requirements and documentation, especially in a global setting where language and direct communication can present challenges. Students often complain and fail to see the importance of effective communication and documentation. A project like this which requires coordination across multiple teams requires strong specification of requirements, code, and work performed.

One particular example was a team that wanted to create an application for ordering food items at a restaurant. Because there were not many specifics about the interface, the U1:USA students that proposed the system were surprised by the color scheme, the menu items selected, and the fact that the currency was in Indian rupees rather than US dollars. In the U1:USA team presentation, these students mentioned that they clearly see the need to be specific and document requirements in an information systems project.

After working on this project, a U2:USA student also realized the importance of communicating through documentation not only for one's own benefit, but also for that of others. This student commented:

> *The interesting thing is that we do documentation, but we just do it for ourselves so we don't really know if we are expressing what we need in the diagram. Are they going to see what we want them to see and do what we want to them to do?*

Studies of project risks have demonstrated the importance of clear, complete requirements for software development efforts [Baccarini, et al. 2004]. During the course of the project, the need for communication regarding code, changes, and the project plan was critical for project success [Schwalbe 2007]. As such, instructors constantly reinforce the need for communication and documentation of requirements, code, and other needs throughout an information systems project, yet students often dismiss the importance of this task. After experiencing the problems that occur with poor communication around documentation, students seemed to understand the importance of these tasks during a project.

Assigned project roles must be well communicated.

Equity in member roles, both perceived and real, proved to be an important factor in students' perception of the success of a project involving teams at multiple class sites. The team members' roles led to some confusion in the project regarding who was exactly responsible for which components. As a result, feedback to prototypes was sometimes incomplete or late as one team waited for the other, not knowing who was responsible.

This problem with communicating roles seemed to filter through the entire project with students viewing themselves not as a single team, but as three sub-teams within a larger team. Generally, this was not a major problem for most teams and may actually be consistent with some situations that occur in a workplace setting in which multiple organizations may work together in a virtual project; however, some teams had moments in which they had an "us versus them" attitude toward their counterparts, leading to some strife within teams.

Technology can help or hinder a project.

Students in technology programs (and many professionals in technology domains) often consider technology a solution to all problems, not a cause. However, the importance of selecting the right technology was a lesson that all of the students seemed to learn from this project. IS researchers are well aware of the importance of using the right technology for the task at hand [Goodhue and Thompson 1995]. The problems experienced with Collanos Workspace showed how a poor choice of technology can hinder progress. Mentioned above as an execution challenge, the communication technology problem faced in the project created several challenges for students. The students from U3:India had a difficult time communicating with their counterparts for the first couple of weeks in the project because of the problems with the original communication tool, Collanos Workspace. As a result, the U1:USA students had to specify a system and the U2:USA students had to suggest changes and model the system with little to no feedback from their U3:India counterparts. Students express their concerns about the communication tool with their instructors and identified the problem with communication tools kept the team from working across geographical and temporal boundaries.

Virtual team members must remain flexible and adapt to changes.

Switching technologies during the project illustrated the stress that can occur when an information systems change is necessary and that technology that better fits the needs of the project, such as Huddle, can improve team productivity.

In the workplace, employees need the ability to adapt to changing technology needs and environments. The traditional structure of the classroom can make it difficult for students to obtain this skill; however, projects like this allow students to see the need to respond and make mid-course corrections when problems arise. A faculty member not involved with this project, but familiar with its design and scope, made the following comment about this type of student experience:

> *Students need hands-on work that is both realistic and engaging, so they can experience first-hand the kind of environment that they will face in the workplace. We cannot hand this knowledge to them on a platter — they must struggle with ambiguous and complex choices, find their way through to a solution, and then reflect on that experience in order to really learn.*

One communication technology does not fit all.

During the project, it was clear that communicating exclusively via Huddle was slow. Some teammates did not regularly log into Huddle and were not aware of new information provided by their teammates. Other students realized that the time difference between the U.S. and India created a substantial time lag for communication. In the final weeks of the project, the instructors asked the teams to have at least one representative from each university converse over Skype (or any other Voice over IP technology) to have a chance to communicate synchronously. Many teams were amazed at how much they could accomplish in a one-hour phone call as compared to three or four days over e-mail. Most students realized that the mandate to use Skype was beneficial. In their final report at the conclusion of the project, one team stated they would make the following change in future iterations of this project:

> *Force teams to communicate via Skype or some other VOIP tool on a weekly or biweekly basis.*

The value of requiring the use of Skype was dramatic for some teams. One team, for example, was stalled in the project so badly that one student from U1:USA approached her instructor asking how to help keep her teammates motivated. She felt the entire team was discouraged due to the problems with overall communication. The instructor encouraged the team to talk on Skype as soon as possible. By the next class period (two days later), the team had a conference call across the three universities. During this meeting between the U1:USA team and the instructor, it was clear that the entire team was excited about the project. This team was then able to conduct two more rounds of change requests. In future iterations of the project, the instructors want to mandate the use of regular Skype calls to encourage better communication throughout the project.

The project must have a high element of "realism."

Many of the students commented about the similarities of the problems and successes within this project to those found in projects in business settings. For many students, it was not difficult to convince them of the benefits of a project like this — especially those that had some work experience (via part-time jobs or internships). Once the project was completed, one student at U1:USA found himself participating in a global project in his work at a local company.

> *I am going to the Philippines in a few weeks to set up another outsourced call center for customer service…. Our developmental difficulties also mirrored real-world situations that I've had at work, where lack of communication and strong management leads to epic failure when requirements are misunderstood or not followed through to completion. … As our workplace becomes more globalized and we continue to outsource, the experience could only become more valuable.*

Some students initially had a sense that the project lacked realism because some tasks or deliverables were too structured or too simplistic. One student from U3:India believed that:

> *The level of work done was low, as in not much technical expertise was needed, the work was rather simple at this level.*

It is important for students to realize that in an organizational setting, not every project will be challenging and some work may not utilize their full talents. In this project, students were assigned to teams, which is unlike many class projects in which students may be able to choose their teammates. However, in the workplace, employees often do not choose their colleagues on a project and must learn how to work with people that have different backgrounds, experience, and skills. Students did understand this requirement of the project and understood that this aspect of the project was more consistent with a real working environment.

Instructor-Related Lessons Learned

Like the student-related lessons, data among the instructors revealed critical issues to support instructor-related project success. Also like the student lessons learened, the instructor lessons learned were realized through interactions between instructors and students as well as the aforementioned data collection sources. Following is a set of instructor-related lessons that can be applied in future iterations of the project.

Instructors must remain engaged and work together.

Undoubtedly, one of the primary opportunities of this entire project was to expose students to the complexities of working in an offshore virtual team development project. This was accomplished primarily through the aforementioned design of the project and the necessary interactions between the students. In all, every participant on the project gained, at minimum, initial exposure to working with other individuals distributed in a global setting. This included the instructors, who had to meet regularly both before and during the project.

Instructors met weekly via e-mail and Skype (i.e., VoIP) to discuss ways to manage and improve the project while it was occurring. It became increasingly important for instructors to meet and discuss what was going on in order to identify and address the challenges during the execution of the project. The primary challenge that the instructors had to address was the need to change the technology during the course of the project. This required coordination among the instructors to find and test an alternative solution and prepare students for the change. Other issues arose when the instructors realized there was some miscommunication about dates for some key deliverables during the project. This required additional communication to resolve these issues and ensure the teams could continue to make progress. In future iterations of this project, it is necessary that instructors regularly communicate about the progress of the project and any issues that arise for the students.

Instructors must plan for schedule differences across the courses.

University structures were a recurring issue during the entire eight-week project. The students at U3:India took part in national exams during the first three weeks of the project and then later they participated in a week-long recruiting event. As a result, team members at the two American universities were left waiting for extended periods of time for working prototypes, thus altering their project timetables. Prior to beginning an offshore project in the future, university calendars, including student exams, interviews, or holidays, should be clearly understood and worked around.

Instructors must establish assessment measures appropriate to each course.

Finally, the evaluation of the project was uniquely difficult. Students are typically graded based on the completion of some exact task. In the case of the project, students were liable for the action of their global team and as a result, the instructors were not able to assign grades based on the success or failure of the information systems. As a result, grades were largely based on personal and team evaluations, two evaluative items that seem distant from the task at hand (see Appendix A). Similar projects adopted in future classes need to identify relevant deliverables that enable the students to achieve the learning objectives that are required for each course.

Instructors must prepare students for potential challenges that may arise.

Of the challenges that occurred in the project, equity in member roles, both perceived and real, proved to be an important factor in students' perception of the success of a project involving teams at multiple class sites. The team members' roles led to some confusion in the project regarding who was exactly responsible for which components. As a result, feedback for prototypes was sometimes incomplete or late as one team waited for the other, not knowing who was responsible.

This problem with communicating roles seemed to filter through the entire project with students viewing themselves not as a single team, but as three sub-teams within a larger team. Generally, this was not a major problem for most teams and may actually be consistent with some situations that occur in a workplace setting in which multiple organizations may work together in a virtual project; however, some teams had moments in which they had an "us versus them" attitude toward their counterparts, leading to some strife within these teams.

Instructors need to explain how the project is similar to and is different from "real world" projects.

In this project, students worked with new and different people and had to adapt their working style and communication skills based on their teammates. This introduced some conflict within some teams, but the majority of issues were overcome as the project progressed (sometimes with and without intervention by the instructor). Some students believed that assigned teams lessened the realism of the project, particularly those in the project management role at U1:USA. Several students seemed to believe that project managers in a real business setting would have the ability to fire or reassign employees if there were issues with job performance or personality conflicts. Other students felt that the project would have been different in a "real world" setting because people would have been able to devote more time on the project and would not have been distracted with other classes or work. To help students understand that these challenges are also common in the workplace, the instructor at U1:USA spent time talking about her own experiences both in the classroom and in individual conversations with students. A guest speaker with project management experience in a virtual setting also reinforced the realism of the project by acknowledging that she has faced these same challenges in a business context.

Instructors need to help students establish reasonable expectations.

The issue of managing expectations is a key risk on software projects [Schmidt 2001], and the need to manage the expectations of the students specifying the information system is necessary in this project as well. Many students were able to see firsthand the challenges that can arise if expectations are improperly set and managed. It was recognized that students often had unrealistic and varying expectations throughout this project. This was first realized when the U1:USA students proposed the information systems that were to be developed. All of the systems were incredibly complex and over-scoped considering there would only be two-to-three weeks of true development time. This short development window was also exacerbated by the fact that the students were working across large geographical and temporal distances. In the first week of the project, U2:USA students worked with the U1:USA students to suggest scaled-down versions of the proposed information systems.

The expectations of the students seemed to vary from team to team. Students at U1:USA had the following to say about the final product of their restaurant ordering system:

> *There are many errors that could have been fixed with more time and more communication however, when asked how our system met our goals of the organization; we were impressed with how much of the design stayed close to our core goals for this project.*

There were many issues with the final product including spelling errors, serious functionality that was lacking, and bugs; however, these students at U1:USA understood the constraints of this project and were pleased to find that some of the requirements they did specify were completed, even if the end product could not be called functional.

Students that were part of one of the most successful software implementations were less than impressed with the end result. These students worked on a backup management system, and while the final product was one of the success stories, the final product did not live up to the students' expectations.

> *This functionality is what made the final iteration fall short of the requirements our team had for this project.*

These students at U1:USA wanted to see more of the core functionality fully developed. Though teams were constantly reminded that the end result would be a prototype, not a working system, their expectations were sometimes at odds at the end of the project.

Instructors need to provide clear direction and structure.

While the project was established to allow students to explore the complexities and nuances of working in a virtual, offshore team, there were occasions where clear direction had to be provided by the instructors. Most of the direction came during the aforementioned planning phase. As mentioned, students were initially provided three example systems before choosing and working on their system. However, the system structure was not specific and was open to the team to decide. In the case of the aforementioned challenged project, it became apparent that the students needed more structure. The projects that each team suggested were too complex for the class project and had to be scaled down by an instructor. One way to overcome this issue could be to use the group of instructors as the CEO or senior management group and have them finalize or approve projects before the work and development begins.

During the execution phase, a reconsideration of the project required may also require direct intervention by the instructors. Examples the instructors experienced in this project included the changes in communication technology and the encouragement of the use of Skype toward the end of the project.

Project Value: Student, Instructor, and Industry Perspectives

From the student's perspective, the project proved to be a unique experience. They learned the values of effective communication, self-directed work, project ambiguity, and working in global, virtual teams. Students involved in the project were asked to reflect on the value of working on the project. Responses were positive and were highly consistent with this particular comment from a student at U1:USA.

> *I value it very highly, especially if students wish to work in an offshoring arena. It opened up our eyes to other students outside of our box of a university. The offshoring project was a phenomenal project and I would suggest it to any student.*

During the last week of the project, several students from U3:India also had a positive reaction to the project. One student specifically stated:

> *It was a wonderful experience working on this project. Looking forward to more such projects in the future.*

To maintain objectivity, university instructors not involved in the project were asked their perceived value from this classroom experience. The reaction was overwhelmingly positive. One information systems instructor had the following comment about this project.

> *Corporations will hire talent wherever it is available to conduct projects to accomplish their IT strategy. Our students need to understand both in concept and practice the role they will play in the software development teams when they graduate today and into the future. To appreciate the complexity, challenge,s and opportunities of global development teams, they will need "real" experiences today that are an integral part of any computing student's curriculum. Actual participation in projects that span culture, time, and geography can result in students that are better engaged and ready to participate in global project teams effectively.*

Instructors in other domains also see the value of projects like this. For example, an international business instructor offered the following viewpoint:

> *In international marketing we have cross-cultural teams as well, and it's amazing to see the difference in simply discussing the cultural differences versus experiencing the different corporate skills, cultural differences, etc. When we look at the economy today, it's going to be all cross-cultural.*

Additionally, a computer science instructor also believed that this type of project can be useful to his students:

> *I find a project that includes virtual, global teams to be very interesting, and something I want to examine more as a possibility for our software engineering students in computer science as well. Working with remote teams, especially across time, cultural differences, and responsibility lines, is excellent preparation for today's software developers, software analysts and team leaders.*

The goal of the project was to provide students with experiences that they may encounter when they enter the workforce. With that, practitioners who were not directly involved in this project, but will be working with the students in the near future, were asked about the perceived value of this type of project from an industry perspective. The project instructors interviewed representatives from six Fortune 1000 companies. The response was overwhelmingly positive.

> *The value of an offshore IS project during college is immeasurable. It is such a fantastic opportunity for students to experience what the business world is like and will give students a competitive advantage entering the workforce. I applaud these teams for their forward thinking and innovation!*

Another representative had the following to say about this project:

> *I believe there is particular value derived from working on a project in class that involves teaming with groups in off-site and offshore locations. The first is simply organizing the effort and learning how to work within the constraints imposed. That's always a valuable lesson, to do with what you are given. Then the value of working with people who are not like you, who have different backgrounds, different ways of working and thinking, it's very broadening and opens the mind to new experiences. It also teaches you that there are a lot of similarities and we can pretty much overcome any obstacles if we just apply ourselves.*

Given the amount of learning that the students and instructors obtained during this project and the positive reaction that students, instructors, and industry have provided, this project is being repeated. The project will benefit from the knowledge gained in the first implementation of the project. It is hoped that this will continue to be a part of these programs and a source of learning for students and instructors taking and teaching these courses.

As information technology professionals are continually finding themselves participating in virtual teams for offshore work, it is becoming increasingly important for students to be prepared in this environment. This project was time-consuming for the instructors to develop and administer; however, the benefits to both the instructors and the students far outweighed the challenges. Students and instructors experienced "ups and downs" throughout the project, but at the conclusion of the project, students and instructors walked away with insights about global projects, virtual teams, communication, and technology that could not be obtained through traditional lecture, discussion, or case studies.

V. DISCUSSION AND CONCLUSIONS

Following the conclusion of the project, the instructors discussed whether it would be repeated a second time. Conversations focused on the work involved in the initial project compared to the value that is provided from the student, instructor, and industry perspectives. Consequently, future iterations of the offshore development project across different IS courses are planned, using the lessons learned as a guide for repeating and improving the project. Instructor-related lessons learned indicate changes in the planning phase focused on alignment of several course aspects, and on ensuring that students understand the realism and expectations for the project. Lessons learned also indicate changes in the execution phase, primarily in providing structure to the students in the areas of group communication and deliverables.

During the planning phase, the instructors must ensure that as many aspects of the distributed courses as possible are aligned. This includes event items such as academic calendars, examinations, recruiting events, and holidays. However, instructors should also consider pedagogical issues such as the type of assignments students are used to creating, the skill levels of students, and the amount of work expected by the education system. It may also prove helpful to discuss if students are primarily full-time or if they work full-time and attend school part-time. Once an understanding of the course schedule and education system has been attained, the details must be worked into the course curriculum, as well as shared with the students, so that everyone involved has clear expectations about the availability of team members and timing of work to be completed. This is important to ensuring that motivation and participation of the students in all classes are at similar levels to the extent possible.

During the planning phase and in the execution phase, it will be important to address the aforementioned realism of the project, which in turn may help students establish realistic expectations for project outcomes. For instance, students can be shown examples from both successful and unsuccessful projects from the first iteration, with the associated comments from students of how the experience benefitted them in the long run. In this phase as well, it would be helpful to have industry representatives discuss the relevance of the project. If possible, it would be very interesting to have students who participated in the first iteration of the project talk with new students participating in the subsequent iterations. By discussing these concepts early in the project, it may help by providing the students with reasonable expectations for the project.

During the execution phase, group communication showed significant room for improvement. Future iterations of this project should consider incorporating best practices related to communication within software projects, as communication is often cited as the reason for failure of a software project. It may be necessary to require certain levels and types of communication, such as weekly group communication via Skype (or other VoIP tools), consistent with software management practice on communications [Schwalbe 2007; Jurison 1999]. Lessons learned by both students and instructors clearly showed the value of direct, personal communication, but students rarely took the initiative in establishing these contacts. Similar to projects in the workplace, communication was found to be critical for the team to understand documented requirements, role activities, and concerns. Assigning points to students based on the amount and quality of communication in the online workspaces would help cement their importance with the students as well as help instructors monitor progress more closely. The use of templates for written status reports and other deliverables may also ensure more consistent creation of professional documentation and should provide more structure for communication among the students.

In addition to grading of communication during the execution phase, the instructors discovered the difficulty in grading the finished results of the many projects. Future iterations of the project must include specific and relevant deliverables that are clearly understood by the students and provide concrete evidence for the instructors to assess. Clearly defined learning objectives must defined so that the deliverables help students understand and achieve the goals of the course, and rubrics must be defined to help students meet the expectations of the instructors. Rubrics will also allow instructors to take into account the success of their own teams, regardless of the success of the other universities' teams, providing a means of contingency planning.

Based on the overall lessons learned from this experience, several conclusions can be drawn. First, there are no universal best practices for the students or instructors to use when completing this project. The nature of the project is highly flexible and requires that the students consider their task, their technology, and their contexts to shape their communicative environment uniquely for their team. By not over-specifying how a technology must be used and when it should be used, students discussed their approaches with fellow classmates, often sharing innovative ideas that became practice among several teams. In other cases, particular teams did well with certain technology designs while others failed. In allowing the students to specify their work environment, the project remained focused on the systems development task at hand without being concerned about achieving necessary behavioral actions.

Second, experiential learning was a key accomplishment from this project. Students were provided a project that remains unique for many of them in their college career. Some may do similar projects through internships, but the level of immersion with other teams distributed across the world is unique for many students. Through this experience, students were able to see the complexities of project ambiguity, self-directed work, and critical thinking and application.

Third, global exposure is excellent for students. The world continues to shrink with respect to communications and students must have exposure to this increasingly common phenomenon. The response from industry has been extremely positive, indicating that students who have this exposure are a critical step ahead of those who do not. As the IS industry continues to hire students and fund universities at an expanding rate, differentiation and exposure to current business practices provides excellent speaking points for both students and instructors.

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APPENDIX A: STUDENT DOCUMENTATION AND INFORMATION

Purpose: The purpose of this assignment is the following:

- Combine your growing expertise in information technology and management concepts with your creative, research, and problem-solving skills.
- Apply concepts learned in our class to a specific project in a manner similar to which you would perform in a work environment.
- Work with students from other locations in a true “virtual team.”
- Demonstrate decision-making and leadership skills within a team.

Overview: This project engages undergraduate students from the U1:USA, U2:USA, and U3:India in offshore development. Given the globalization of the workplace in today’s digital world, it is appropriate for you to consider offshore development in the United States to countries as India, China, and Argentina. Furthermore, Gartner suggests that 60 percent of offshore work will be done in virtual teams by 2008.

To perform this project, you and students from two other universities will work together for an offshore development project. This project will expose you to the complexities of time and cultural differences in a systems development project.

Benefits: All students are expected to benefit from the proposed project. The following table lists the benefits for students at each of their respective universities:

Proposed Benefit	**U1:USA**	**U2:USA**	**U3:USA**
Complexities of Time	All students are responsible for working and coordinating activities across a 12-hour time difference.		
Complexities of Culture	All students are responsible for working and coordinating activities in light of cultural differences.		
Learning about Collaboration Technologies	All students will use and become familiar with advanced collaboration technologies used to work in virtual teams.		
Systems Conception, Design, Development, and Implementation	Improve leadership and decision-making skills.	Improve specification, auditing, and implementation skills.	Improve design and development skills.

Timeline: For the U1:USA students, the project will begin on Jan 22. You will be assigned to a team and given a role within your team by this date. You will be assigned teammates in U2:USA and U3:India no later than Jan 25.

This project has a seven-week timeline for U1:USA students and will be completed before spring break.

Duties:
U1:USA Students – For this project, you will be performing the following tasks:
1. Develop a new business or improve upon an existing business.
2. Propose an online system that accomplishes an organizational objective for this business.
3. Monitor, control, and manage the design and development process.
4. Pilot the system through the use cases with test users.
5. Report on the progress of the project and final deliverables.

U2:USA Students – For this project, you will be performing the following tasks:
1. Receive an “order” from the U1:USA students. It is your job to understand the complexity of the project and work use cases that represent the flow of the system.
2. Work with the U1:USA students to model their proposed system.
3. Following the modeling, you and the U1:USA team will pass the associated documents to the teams in U3:India.
4. Following the return of the systems, you will load the system to an available computer system.
5. Along with the U1:USA students you will pilot the system through the use cases and with test users.

U3:India Students – For this project, you will be performing the following tasks:
1. Provide technical expertise and guidance on the choice of technology and feasibility of the proposed system.
2. Receive a “work order” from the U1:USA and U2:USA students for a system that needs to be designed and built.
3. Develop a prototype for the U1:USA and U2:USA students.
4. Respond to change requests for the development of an updated system.

Technology: Students need to download and install Collanos Workspace for this project. This software allows you to share documents, send messages, chat, and communicate among your team. All team members across universities are expected to use this tool. This should provide your team a “one-stop shop” for all of your communication needs. This tool is free to download from www.collanos.com.

A workspace will be created in Collanos for each team. You will be invited to join your team’s workspace by the VTCoordinator.

The Project: Students will be assigned to teams of 9-10 (3-4 from U1:USA, 2 from U2:USA, 2 from U3:India). Each student from U1:USA will be given assigned roleS of project manager, project sponsor, internal auditor, and user. Each role will have different duties and a different perspective within the team.

- Project Manager – responsible for developing a project plan and ensuring the project plan is executed by the team appropriately; documents and monitors the change management process
- Internal Auditor – responsible for ensuring each of the deliverables within the U1:USA team meet your quality standards before disseminating to the team; has the responsibility to test and ensure the system meets the sponsor and user needs based on the requirements they specify
- Project Sponsor – responsible for identifying the system that needs to be developed; identifies and documents user requirements; examines the prototype and completed system to examine if the system meets the requirements specified
- User – responsible for identifying and documenting specific requirements for the needed system; works with the project sponsor to identify changes that are necessary after the prototype is completed

General Timeline:
Week 0: Developing a Business, Proposing a System
U1:USA Students

- Entire team: Install Collanos and send your user name to instructor.
- *Entire team:* Identify the business that will serve as the context for the project.
- *Project Sponsor & User:* Propose a work process that can benefit from the use of technology.
- *Project Manager & Internal Auditor:* Discuss the system with the project sponsor and user to ensure the idea is complete and meets the requirements.

Week 1: Developing a Plan, Meeting the Team
All Students

- Meet the team from U2:USA and U3:India.

U1:USA Students

- *Project Sponsor & User:* Once the idea has been approved, identify specific functionality for the system.
- *Project Manager & Internal Auditor:* Develop a timeline for accomplishing the activities required for the project; communicate timeline to the U2:USA and U3:India teammates.
- *Project Sponsor, User, & Internal Auditor:* Work with U2:USA teammates to finalize the requirements and features of the system.

U2:USA Students

- The U2:USA students will be informed of what the system does and what the technology features are.
- Work with the U1:USA students to finalize the requirements and details of the system, such as how the system should work, be designed, and be implemented.

Week 2: Developing Specifications, Starting Development
U1:USA Students

- *Project Manager & Internal Auditor:* Monitor the progress of the project among the U2:USA and U3:India teammates.
- *Project Sponsor & User:* Provide answers to any questions that the U2:USA and U3:India teammates may have about the system.

U2:USA Students

- Meet with both the U1:USA students (i.e., project sponsors) and U3:India students (i.e., software developers)
- Develop specifications to be presented to U3:India students.

U3:India Students

- Work with U1:USA and U2:USA students to ensure requirements and specifications are clear.
- Begin preliminary development based on the specifications.

Week 3: Prototype 1, Change Requests
U1:USA Students

- *Internal Auditor, Project Sponsor, & User:* Examine prototype to evaluate how well prototype adheres to specifications and requirements provided.
- *Project Manager, Internal Auditor, Project Sponsor, & User:* Consider possible change requests.
- *Project Manager & Internal Auditor:* Monitor the progress of the project among the U2:USA and U3:India teammates.

U3:India Students

- Deliver a prototype to the U1:USA and U2:USA students.
- Begin secondary development based on the change requests or specifications from the U2:USA and U1:USA students.

U2:USA Students

- Examine prototype to evaluate how well prototype adheres to specifications provided.
- Consider possible change requests.

Week 4: Second System, Final Changes

U1:USA Students

- *Internal Auditor, Project Sponsor, & User:* Examine second system to evaluate how well system adheres to specifications provided.
- *Project Sponsor, & User*: Document any other changes needed and share with the project manager and internal auditor.
- *Internal Auditor & Project Manager:* Develop a report for the U2:USA and U3:India teammates documenting changes that are needed.
- *Project Manager & Internal Auditor*: Monitor the progress of the project among the U2:USA and U3:India teammates.

U3:India Students

- Deliver a second system to U1:USA and U2:USA students.
- Make any final changes/adjustments to the system posed by U1:USA and U2:USA students.

U2:USA Students

- Examine second system to evaluate how well system adheres to specifications provided.
- Document any other changes needed.

Week 5: System Test, Implementation

U1:USA Students

- *Internal Auditor, Project Sponsor, & User:* Participate in the testing and implementation of the system.
- *Project Manager & Internal Auditor*: Monitor the progress of the project among the U2:USA and U3:India teammates.

U2:USA Students

- Test and Implement system.
- Present final system to U1:USA students.

Week 6: Final Development Logs, Presentations

U1:USA Students

- *All:* Compile a final team report.
- *All:* Write an individual reflection paper on what they learned in this project in terms of 1) working in a virtual team with people from different locations and cultures; 2) experiences in managing a virtual team; 3) what they learned from the project.

U2:USA Students

- Create development logs.
- Prepare presentation.

U3:India Students

- Complete final deliverables

Week 7: Presentations

U1:USA Students

- *All:* Present a 15-minute team presentation on the system created, their experiences, and what they learned as a team.

APPENDIX B: TEAM STATUS REPORT

Subject: Status Report   Authors:
Date:
Business name: University Library Project

Status Report

We are currently waiting to receive the fully developed system from U3:India. At this point, the team has met all deadlines. The status report is separated into the three major deliverables that have been completed thus far: business idea proposal, modeling documentation, and initial system prototype.

Business Idea Proposal

U1:USA submitted a proposal to create an inventory tracking and mapping system for the university library. This original proposal was over-scoped. A second document was received the following day changing the requirements and narrowing the scope of the system. U2:USA students submitted an initial response to these two documents requesting to redefine some of the requirements to create proper scope for U3:India and requesting the necessary information to create the system. U1:USA approved the changes to the requirements and provided U2:USA students with the information requested.

Modeling Documentation

Students from U2:USA developed modeling documentation including a DFD, ERD, Sequence Diagram, and maps to send to U3:India. One week later U3:India contacted U2:USA with questions and comments on the documentation they received. The following day there was extensive conversation between U2:USA and U3:India to clarify requirements before development began.

Initial System Prototype

Several days following the conversation, an initial prototype of the Inventory Tracking and Mapping System was submitted to U2:USA students. After reviewing the system, U2:USA sent a response with further clarifications, requirements, and suggested changes. Included in this document was the metrics that will be used to evaluate the written code in the fully developed system.

To ensure the completion of a successful project, all teammates need to continue with rapid responses and continue to meet deadlines. Once U3:USA completes the system, U2:USA and U1:USA will evaluate it, any necessary changes will be completed, and implementation will take place.

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