1-1-2007

Bringing Global Sourcing into The Classroom: Experiential Learning Via a Global Software Development Project

Monica Adya
Marquette University, monica.adya@marquette.edu

Dhruv Nath
Management Development Institute

Varadharajan Sridhar
Management Development Institute

Amit Malik
Management Development Institute

Accepted version. Published as part of the conference, *Proceedings of the ACM SIGMIS Computer Personnel Research*, 2007, 20-27. DOI.

Bringing Global Sourcing into The Classroom: Experiential Learning Via a Global Software Development Project

Monica Adya
Department of Management, Marquette University
Milwaukee, WI
Dhruv Nath
Management Development Institute
Gurgaon-122001, India
Varadharajan Sridhar
Management Development Institute
Gurgaon-122001, India
Amit Malik
Management Development Institute
Gurgaon-122001, India

Abstract:
The growing trend in offshore software development has imposed new skills requirements on collaborating global partners. In the U.S. this has translated into skill sets that include communications, project management, business analysis, and team management. In a virtual setting, these skills take on a complex proportion. This paper describes an educational initiative in offshore

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

software development between undergraduate students enrolled in a project management course at Marquette University, USA and graduate business students enrolled in an Information Systems Analysis and Design course at Management Development Institute, India. The course replicated an offshore client/vendor relationship in a virtual setting. For faculty considering such initiatives, this paper describes the setting and factors critical to success of this initiative and cautions against others that can be detrimental to such an effort.

Keywords: Virtual teams, success factors, global communications, project management, time zone management, cultural differences

Introduction

Spurred by cost efficiencies, improvements in telecommunications and technological infrastructure [5], availability of skilled IT professionals, as well as improved quality and communications standards in vendor countries, the software industry has experienced exponential growth in IT outsourcing to offshore locations such as India, China, and Russia. This trend is further fueled by shortages in current IT workforce due to low output of professionals from universities as well as gaps left by retiring baby-boomer generation [11, 15]. Global sourcing has contributed to a dramatic shift in skill requirements of U.S. IT workforce. Business analysts, relationship managers, and project managers who can effectively communicate with offshore teams and manage global project risks are desirable IT candidates [1]. Educational institutions, consequently, are being challenged to redesign and introduce innovations into their curricula to meet these needs.

In this paper, we describe an initiative in global software development between Marquette University (MU), USA and Management Development Institute (MDI), India. MU IT student teams were engaged as clients/project managers who outsourced software analysis and design work to MDI teams. Unlike typical corporate settings where software teams have physical access to vendor locations, rich communications technologies, and well defined exchange processes for requirements gathering, student teams were restricted to communications via e-mail and instant messaging, making this a truly virtual undertaking. This imposed greater demands on communication and co-ordination than in a real world setting,

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

thereby providing IT students with the learning opportunity necessary for success in a global world [4].

At many levels this undertaking between MDI and MU could have failed due to distance, culture, and motivation. Yet, at several levels it was a success. In this paper, we describe our implementation and discuss factors that worked and those that did not. The next section describes the course setting and class constructs. Subsequent sections describe factors critical to success and cautions for educators considering such an initiative. The learning as well as implications for educators, researchers, and practitioners.

1. Description Of Experiential Project

1.1 The Learning Environment

Undergraduate business students enrolled at MU in an IT Project Management course were paired with MBA students enrolled in Information Systems Analysis and Design (ISAD) course at MDI. Course objectives for MU and MDI are listed in Table 1.

Figure 1 (a) illustrates the multi-team environment that was created by pairing each MU team with two MDI teams (A and B). MU teams were asked to use differential management styles with the two MDI teams, managing one team with tightly (Team A) and the other loosely (Team B). Team A, was required to provide a project plan to MU teams, submit weekly status report, and interact routinely with the MU team lead. Team B was expected to take the initiative in defining communication with their MU team, and was only tasked with final delivery on time and as required. Intermediate interactions with Team B were to be at the behest of Team B but were not required by the MU team. This setup enabled MU teams to observe virtual team behavior in two settings and drive home possible lessons regarding management and communication styles.

Further, each MDI team (B) was also engaged in doing a collocated project with MDI team (A) as shown in Figure 1(b). This was carried out to assess the performance of virtual teams vis-àvis co-located teams.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

1.2 The Team Projects

Client MU teams managed projects obtained from MUs past service learning initiatives which are typically limited in scope. Examples include a web-based donation management system, an alumni website, and an e-commerce site for small coffee house. Complexity was consistent across all projects. Since the analysis and design were to be conducted at MDI, MU teams only provided high level descriptions of projects. Detailed requirements were gathered by MDI teams through subsequent client interactions in virtual mode. Constraining project scope was essential due to limited overlap between MU and MDI semesters between September and November 2005.

1.3 Virtual Team Communications

Virtual teams engaged in one week of socialization prior to exchange of project details. During this period, students exchanged profiles, determined viable communication methods and media, and set initial expectations. No project requirements were exchanged during this period. Virtual teams were provided with an array of technologies for communication but were required to determine the best communication mode for themselves based on time constraints and team preferences. Most students relied on instant messaging (IM) and e-mail exchange during socialization but did not attempt to use desktop conferencing or other richer communication media. Time zone differences and limited access to computer technology and networks were cited as the most common reasons for limited use of richer media.

1.4 Class Deliverables

MU teams were required to submit all traditional project documentation starting with a project charter and concluding with final project signoff to MDI teams. MU students built plans and schedules, conducted risk assessment, and developed contingency and communications plans. The offshore setting required students to think beyond traditional communications and risks. For instance, identified

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

risks ranged from lack of cohesion with virtual team to impact of natural disasters, recognizing the recent South Asian tsunami.

As developers, both MDI teams submitted project plans, vision document, use case diagram, use case specifications, supplementary specifications, glossary, class diagram and sequence diagram and screen-based prototypes. In addition, the tightly controlled team (Team A) submitted weekly status reports and interim prototypes. Table 2 above summarizes these deliverables.

1.5 Class Outcomes

Student learning was measured in several ways. At MU, students wrote weekly status reports that reflected upon learning about project management, communications, and virtual team management. Additionally, both virtual teams completed three surveys during the semester describing their learning experiences. Summary results from these surveys are presented later in this paper.

Several MU students indicated improved marketability as a result of exposure to this virtual team environment. Student validations, such as the one below, reinforced this outcome:

> Compared to the 21 other students I interviewed with I was the one with the least technical experience but I was the only one that had the chance to manage remote teams to produce a project. In each of my interviews with [Fortune 500 company name blocked] as well as with [company as a college student I had the chance to be involved in a real project that dealt with an offshore team (or teams). *[Extract from an MU student's personal email to instructor.]*

From faculty perspectives, the course provided an opportunity for collaborative research between MU and MDI faculty as well as an opportunity to reflect current workforce needs in the curriculum. Furthermore, participating faculty demonstrated a high willingness to continue future collaboration due to the strong working relationship established during the first time offering. Finally, the MU version of the course received excellent ratings for that semester and enrollments for Fall 2006 increased by 200%.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

2. Critical Success Factors For Virtual Team Projects

Collaborative ventures such as this virtual project face a range of detrimental risks that potentially threaten success. Foremost is obtaining institutional and resource commitment. Where such commitment does exist, participating faculty must work cohesively, have shared objectives, and demonstrate sustained commitment and enthusiasm for the collaboration. This is particularly critical since many international collaborations are initiated between individual faculty and then trickle up to the institutional level. Finally, student buy-in and commitment is essential since often the tasks of virtual teamwork can place unprecedented demands. In this section, we describe a range of factors that we perceive as critical success factors.

2.1 Faculty Related Factors

Faculty Must Have Shared Vision and Objectives

Collaborating faculty must share a vision for what students should achieve from a global software development project. This means putting aside personal agendas and taking the risk required for such initiatives, a conflict for untenured faculty who have to balance teaching and research initiatives. Recognizing this, a major motivation for both MDI and MU faculty was to have recognizable research outcome from this undertaking. Consequently, from the outset course planning and design emphasized teaching research, and long term commitment between participating faculty.

Faculty Must Experience Virtual Work to Relate to Student Experiences

While virtual collaboration is not uncommon in research settings, usually research partners have met and have established trust and communication standards. MDI and MU faculty did not have prior affiliation since they met via ISWorld in response to a request for collaborative work. Coincidentally, MU faculty had received a grant from 3M Foundation to pursue innovative changes to IT curricula and

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

were searching for similar partnerships. Prior to this, faculty members had no face-to-face interaction and in fact, did not have any such interaction until the completion of the first semester of collaborative teaching in December 2005. Faculty limited themselves to the same communications tools as students, did not phone each other despite availability of the resource, and designed, developed, and executed the courses in virtual mode. Since most of the design and development occurred over summer 2005, by Fall, both faculty had obtained experiences similar to what students would undergo, had understood how time zones could be leveraged, and identified appropriate media for communication. Consequently, we were able to provide better guidance and problem resolution strategies than possible without such experience.

Communication between Faculty Must Be Defined, Frequent, and Clear

At both MDI and MU, students were taught that unclear, unresponsive, and ill-defined communication in a virtual setting can result in rapid breakdown of team trust. This guideline was used extensively by involved faculty as well. E-mails were often responded to within 24 hours. All collaborators were copied on messages and if one was unable to respond, the other would indicate expected response time. Faculty members informed each other of unavailability during critical phases. Since most communication was via e-mail, all points were bulleted in order to facilitate readability and assimilation of key issues. Faculty had to carefully draft out messages so that ideas were conveyed clearly. Most e-mails opened or ended on a personal note which continued to improve and enhance the spirit of collaboration. Most critically, all communication was respectful yet informal.

Faculty Must Complement Each Other's Competencies and Roles

With the triple objectives of research, teaching, and student support, MU and MDI team members rapidly established roles that complemented each other. One MDI faculty focused on experimental design in collaboration with the doctoral student while the two faculty who were teaching collaborative courses in MDI and MU focused on

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

integrating these research and educational visions into their course design. This ensured that roles were clearly defined, all elements of the vision were being executed, and different yet complementary perspectives were being input into the end product.

Faculty Must Demonstrate Commitment and Enthusiasm

Leveraging such a collaborative relationship required sustained commitment to this undertaking and long term enthusiasm. With well defined roles, it could have been easy to overlook input from a member during design of research and teaching components. There was also the risk of overburdening one faculty member simply because it was his/her role. MU and MDI faculty ensured that all faculty participants provided input into each component, a factor that ensured buy in from all members. At our December 2005 debriefing, all involved faculty members agreed that this may have been the single most critical success factor for this project.

Faculty Must Actively Manage Student Expectations

Both the faculty and students engaged in this project did not have analogous experience from other projects. As a result, we established an open relationship with students clearly laying out the novelty of the venture and the underlying risks. Expectation management became important for student buy-in and sustained commitment during challenging periods of the project. For instance, one faculty's opening comments to the class were:

> I am going to experience and learn from this project with you. There are many things I will learn from you and many things that we will have to figure out as we go along.

This set the tone for students' relationship with the instructor more as an experiential partner than a teacher. Students would freely share their challenges in the classroom and more interestingly, would present solutions they would have thought about or experimented with already rather than expecting the instructor to come up with a solution each time, thereby making the in-class environment more experiential than originally planned.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

2.2 Student Related Factors

Although virtual work provides enriched learning opportunities, it can be demanding and frustrating for participating students. At such times, it is easy to loose sight of long term benefits. Consequently, to reduce the pressures of fire-fighting, faculty will benefit from actively managing student expectations, enabling trust between virtual teams, preparing students for contingencies, providing dedicated discussion times, and creating an environment where students can self-reflect and find solutions. We discuss these and other student-level factors in this section.

Allow Virtual Teams to Socialize

Virtual teams must socialize and get to know each other before engaging themselves in their projects. In our initiative, students could select their socialization medium. While all teams used some form of socialization, some more than others, teams that did only moderately engaged in socialization appeared to struggle with cohesion throughout the semester.

> I have no complaints about our MDI team because they do their best in response to the way we communicate. We are a "business-like" group which to me leads to no social interaction since early on. We started from the business end and skipped social aspects which has put us in this position. It works somewhat well, but leads our group to feel nervous out the submission of upcoming deliverables and status reports. [*Extract from weekly report submitted by MU student*]

While guiding groups demonstrating low interaction, faculty must caution teams that continue to mingle extensively beyond the socialization period. These teams can harm their task productivity and get overwhelmed by excessive socialization. To increase awareness of socialization, MU teams were required to read and discuss a case study by [2] which compares team performance on systems development projects with varied periods of socialization.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

Provide Opportunities for Self-Reflection and Self-Correction

Often the richest learning environment emerges when students learn experientially and self-reflection is facilitated by the instructor. We created such an environment by providing high level guidance to students, allowing them to discover implementation details that best suited their effectiveness, and requiring them to routinely reflect on failures and successes. Providing this flexibility forced students to experiment with alternate strategies, reflect upon their work styles and habits, and determine best fit between the two.

Students would make mistakes and get frustrated with the process. To prevent escalation of these negative perceptions, instructors must provide opportunities for discussion in the classroom setting, enabling the students to voice their experiences and frustration and working toward a solution. Students realize that others face similar situations and work more cohesively towards problem resolution. The following extract from a weekly report illustrates the benefits of self reflection. Issues such as one described below could be raised in an open discussion where the class can collectively engage in problem resolution.

> After the initial communication with the Indian team, my personal confidence in the project has decreased. The reason for this is very simple: we need to find a better way to communicate with the teams… In the end I am hoping the lack of communication this past week was due to busy schedules. Hopefully we can set up a system of days/ times to communicate every week, no matter what … We need to find a way to reenergize the whole team to be excited and ready to get to work on the project *[Extract from MU student's weekly report]*

Such active learning and reflective strategies will impose demands on class time. We suggest that instructors should build open discussion time into their course plan to facilitate reflection without veering off course plan.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

Recognize that Individual Characteristics Can Impact Team Motivation

Individual characteristics have been shown to effect team atmosphere [9], group cohesion [15], and conflict resolution [8]. In a virtual setting, the impact of individual characteristics on team cohesion is often greater and requires more active monitoring and mitigation since the virtual team has no obligation to the remote instructor. This is particularly so for teams whose trust foundation is weak.

For us, two teams in particular demonstrated interesting contrasts. Team *Communicative* [names masked by authors] was lead by a team member who had some global exposure through service learning and demonstrated exceptional commitment to learning and the project. This person was an active communicator, a good listener, and enjoyed meeting new people. This team was able to build strong relationships with one of their MDI teams which was also led by a similarly communicative leader. Team *Communicative* attributed the on-time and high quality of their project to trust and cohesion with this virtual team.

Team *Reticent* was lead by a leader who was quiet and reserved not only with virtual teams but also with the local team members. Two of this team's members felt that the team lead's noncommunicative personality was detrimental to the team's cohesion. This team struggled throughout the semester to establish ground rules regarding communication and outcomes. Eventually, only part of this team's project was delivered on time and as required.

Cultural and Time Zone Similarities/Differences Should be Made Active Part of Class Discussions

Other than imparting course content, cultural and time zone orientation for students became an active part of classroom discussion. These issues are of greater significance between U.S. and India where both culture and time zone differences are vast. Students were familiarized with both national and work culture. MU students, for instance, were provided links to websites about the history, music,

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

food, and religion of India. Work culture was highlighted by inviting speakers who had experience with both Indian and American workplace and could highlight differences and similarities between the two cultures. Similarly, strategies for leveraging time zone differences were communicated at various points during the semester.

Much of the enrichment, however, emerged from first-hand experience with time and cultural differences. For instance, some teams began understanding the challenges of time zones after failed attempts at organizing IM sessions with virtual teams. Instructors can make an effective learning environment by reinforcing these issues as they are encountered in weekly reports and in-class discussions.

> One major concern that was realized by our team over the weekend was that we will need to pay much more attention to the time differences between ourselves and the Indian teams than we had originally thought. Within our own team we began talking about how daylight savings time would affect when email updates would be received. We also discussed how we would not be as available to respond to any project submissions made by the MDI teams over the Thanksgiving holiday. If we were working on this project amongst ourselves or with other teams in the U.S. we would not have thought twice about not being very available over Thanksgiving break, but we must realize that the MDI teams will be expecting to continue working during the break. They will be expecting to maintain our existing means and frequency of communication regardless of what holiday customs we have. [*Extract from MU weekly report*]

2.3 Technological Factors

Fit Technology to Task and Work Styles

While certain base technologies must be required for virtual projects, instructors should enable students to determine which technology fits the task and their work habits. In our virtual project, most teams eventually determined that IM was most effective for socialization but not for project execution and preferred to use e-mail for it. Two teams, on the other hand, who felt acutely the lack of communications from their virtual teams chose IM to routinely trigger conversation about the project and then followed up with e-mail.

With regard to project management technologies, all teams at MU and MDI were required to develop their project plans in MS Project. While one team attempted to use Excel spreadsheet later in the semester, they soon realized the flexibility provided by the tool and reverted back to it. Another team found that project simplicity and customizability of Excel spreadsheets made it a better tool for planning and they remained dedicated to it as a planning tool.

Two teams used content management websites to manage and post their documentation. Students might find free online content management sites such as www.plone.com or www.jot.com useful for their projects. Most of the sites offer a free version with limited space. Larger spaces can be bought a reasonable cost. These teams perceived smoother documentation management and communication with virtual teams. Other teams preferred to use Google mail due to larger allocated space and its threaded message storing format. Students must be familiarized with three layers of technology – communications tools, project planning and monitoring tools, and documentation management tools which include content management and requirements modeling tools. Teams must be encouraged to recognize their work styles and habits and fit technologies to these as well.

Anticipate and Manage Technological Risks

While it is tempting to equip students with uniform technologies at both locations, in reality, technology standardization is achieved between client and vendor organizations primarily via negotiation. At instructor level, we negotiated use of certain basic tools such as e-mail, IM , and MS Project. However, students were to negotiate requirements modeling and other communication tools. While most MU students used MSN Messenger for IM and voice chats, MDI teams were more comfortable using Yahoo Messenger. MDI team members also discovered partially through the definition stage that MU students were unfamiliar with the design tool, Rational Rose. MDI teams, who were tasked with providing support and explanations for any deliverables to MU teams, quickly discovered that Rational Rose outputs could be translated into Microsoft Word documents and this became the mode for exchange. As an MU student point out: "this made me aware of a

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

new tool and forced me to learn about it". To provide a more realistic experience, there is value in letting students negotiate at some level. However, instructors must be prepared to manage technological risks and step in when student level negotiations fail.

Technology downtime is also a significant risk in virtual project settings. On short timelines, such outages can frustrate students and hamper the learning environment. For instance, in October 2005, during project kickoff, MDI experienced short downtime in its e-mail environment. As soon MDI stabilized, MU experienced loss of external connectivity for two days. Consequently students faced 3-4 non-communication days during critical project time. The instructors suggested use of alternate e-mail addresses and soon, it became a norm to copy all e-mails to primary and secondary e-mail addresses subsequent to which there were few complaints regarding communication technologies.

Student Mindset Must Be Trained To Use Technologies for Task Accomplishment

Most undergraduate students actively use e-mail and IM for social communication. Consequently, students demonstrated little discomfort with these tools. Interestingly, the project necessitated use of these tools for task accomplishment, something they did expressed difficulty with. For instance, a common discussion with MU students was how to word their e-mail messages so as not to offend their MDI counterparts and yet convey the requirements firmly. As one student pointed out "I did not realize how important it was to appropriately word my e-mail messages for work purposes!" Another indicated how he had to go into a chat session with a written agenda because his team would often steer towards social conversation and needed to come "back on track". Instructors can use project discussion time and required submissions to train students on these aspects of communication management.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

2.4 Class Constructs

Design Manageable Projects

Since virtual team projects involve additional workload for faculty and students, it is important to keep the projects under manageable size and complexity while reflecting reality. Though most of the class room based virtual team projects are of short duration, [4] conducted virtual team based class projects extending up to 32 weeks. The disadvantages of conducting small duration (about 4-6 weeks) project which restricts the study of certain steady state behavior of teams are described in [3]. While project duration in our study was 8 weeks, preliminary preparations conducted by the faculty reduced coordination and time delays.

Virtual Team Roles must be Complementary not Competitive

The synergy in a virtual project can be maintained best when the two teams are given different roles that complement each other. In our case, MDI students' role as developers was complementary to MU students' role as project managers. Not only did this arrangement reduce the potential for conflict and role ambiguity, it also enabled students to observe dependencies that exist even in complementary roles. For instance, MU students could only provide status reports to their instructor once they had received meaningful status reports from their MDI partners. This arrangement could also potentially enable teams to work in a greater spirit of partnership as we discuss next.

Create an Environment of Partnership

To minimize the feeling of "us versus them", faculty must work towards inculcating a spirit of partnership between virtual teams. For this project, cooperation at the faculty level better informed the collaborative nature of this undertaking. The grading structure did not reflect any competitiveness at the virtual team level. While there was ample opportunity to blame problems on virtual teams or technologies, instructors typically asked the local teams what they could have done better or differently. The focus then shifted to problem solving rather than continue towards fingerpointing. After a few such initial

encounters, this problem-solving mindset became the norm for most students.

3. Assessment Of Student Perceptions

This study built a platform similar to [3, 12, 13] to help a new set of project managers and software developers better understand the nature of working in a distributed collaborative software development environment.

Did the participated students demonstrate greater propensity and motivation to virtual project work? Were they comfortable working with remote teams? Did they better understand the process, benefits, and challenges of global software development? To elicit answers to the above questions, a survey was conducted at the end of the project to measure the motivation, comfort and learning effectiveness of the participants using a 7-point Likert scale. Survey items for the above were adopted from [3, 6, 10].

Table 3 provides mean values and ANOVA results for the above variables across MU and MDI teams. On all the three parameters, the perceptions of MU students and MDI students did not differ significantly. The high mean values of both the teams clearly indicate that students were positively oriented toward the virtual team project on all parameters. We recommend that such virtual team exercises be integreated in other business courses to enhance effectiveness of student learning.

4. Recommendation for Future Undertakings

In this section, we highlight recommendations for future undertakings. Despite teaching and research returns, sustained institutional commitment is necessary to facilitate long term implementation. Another area that needs attention is provisioning a range of technologies to enhance communications in a virtual environment.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

Institutional Support and Shared Vision

While initiatives such as these require little direct administrative involvement, greater success and improved creativity can be achieved when both institutions share a vision for global outreach. Virtual classroom collaboration requires significant planning and communication in order to be cohesive at both locations. Instructors are required to meet internal learning requirements while extending traditional classroom objectives to their virtual partners. Managing student expectations and experiences can impose significant demands in contrast to traditional classroom setting. Trouble shooting team issues, identifying communication methods and content, defining manageable projects, and managing partner relationships all take on greater magnitude in virtual projects. These demands can be discouraging without perceived support. Universities can obtain more willing participation and elicit innovative initiatives if incentives can be provided in terms of course releases, monetary compensation, and other benefits to motivate faculty. Commitment can also be demonstrated by providing flexibility in curriculum development.

Incorporate Media-Rich Technologies for Effective Communication

Differences in time zones and technological access can limit richness of communication between virtual teams. While it is increasingly common in industry to enable face-to-face, videoconferencing, or phone communications between virtual teams, we had limited access to these facilities. For students had access to desktop conferencing capability, time zone differences further limited the ability to communicate in real-time. Students were restricted to e-mail and IM. Although we are unsure whether richer communications could have helped improve learning, for future undertakings, instructors can explore this issue.

5. Implications for Academia and Practice

As IT workforce needs reflect skill needs such as communications, team management, and business analysis, international collaborative projects provide opportunities to impart

these skills while exposing IT students to global software development. From an organizational perspective, companies can expect to hire employees who are better prepared for global initiatives, have greater understanding work ethics and time zones, and are culturally sensitive. A secondary benefit is that such course offerings have renewed waning interest in IT programs and majors. Finally, collaborative initiatives provide rich research opportunities ranging from use of technologies for virtual collaboration to use of agile and rapid development methodologies in virtual settings.

Students view such innovative offerings positively. MU and MDI participants demonstrated high levels of motivation, comfort, and learning with virtual team projects. Instructors should ensure that participants' comfort and motivation level are kept high by monitoring their engagement in the projects. Our experiences and recommendations, which we hope provide an initial starting point for faculty exploring such initiatives, are summarized in Table 4. Additional course materials are available from authors.

6. References

[1] Abraham, T., Beath, C., Bullen, C., Gallagher, K., Goles, T.,Howland, J., Kaiser, K. M., Simon, J. IT workforce trends: Implications for IS programs. *Communications for the Association for Information Systems,* 17 (June 2006), 1147-1170.

[2] Croasdell, D., Fox, A., Sarker, S. Systems development by virtual project teams: A comparative study of four cases. *Annals of Cases in Information Technology Applications and Management in Organizations*, 5 (2003), 447-463.

[3] Edwards, K., and Sridhar, V. Analysis of software requirements engineering exercises in a global virtual team setup. *Journal of Global Information Management*, 13, (April-June 2005), 21-41.

[4] Favela, J., and Pena-Mora, F. An experience in collaborative software engineering education. *IEEE Software*, (March/April 2002), 47-53.

[5] Gopal, A., Mukhopadhyay, T., and Krishnan, M.S. The role of software processes and communications in offshore software development. *Communications of the ACM*, 45(4, 2002), 193-200.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

[6] Jarvenpaa, S., Knoll, K. and Leidner, D. Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14(4, 1998), 29-64.
[7] Jarvenpaa, S. and Leidner, D. Communication and trust in global virtual teams, *Organization Science*, 10(6, 1999), 791-815.
[8] Jourdain, K. "Communication Styles and Conflict," *The Journal for Quality and Participation*, 27(2), 2004, pp. 23-25.
[9] Kleinmann, G., Palmon, D., and Lee P. "The Effects of Personal and Group Level Factors on the Outcomes of Simulated Auditor and Client Teams," *Group Decision and Negotiation*, 12, 2003, pp. 57-84.
[10] Lurey, J. and Raisinhgani, M. An empirical study of best practices in virtual teams. *Information & Management*, 38 (8, 2001), 523-544.
[11] Murphy, C. Speak up for the IT career. *Information Week*, 1058 (October, 2003), 34-41.
[12] Nath, D., Sridhar, V., and Malik, A. Effectiveness of the twophase software off-Shoring model. In *Proceedings of the First International Conference on Management of Globally Distributed Work*, Indian Institute of Management, Bangalore, India, December 28-30, 2005, 159-170.
[13] Nath, D., Sridhar, V. Adya, M., and Malik, A. The effect of user project monitoring on the performance of virtual teams in the requirements analysis phase of off-shored software projects". In *Proceedings of INFORMS Conference on Information Systems and Technology (CIST) 2006*, November 4-5, 2006, Pittsburgh, PA, USA.
[14] Stewart, G., Fulmer, I., and Barrick, M. An exploration of member roles as a multilevel linking mechanism for individual traits and team outcomes. *Personnel Psychology*, 58(2, 2005), 343-365.
[15] Zhang, W. Why IS: Understanding the factors influencing undergraduate students intention to choose IS major In business schools. *Proceedings of the SIGMIS Computer Personnel Research (SIGMIS CPR),* 2006, 311-313, Claremont, CA.

Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.

Table 1: Course Objectives for MU and MDI Teams

MU Course Objectives	MDI Course Objectives
Learn concepts of IT project management	Learn Information Systems Analysis & Design (ISAD) process, specifically Rational Unified Process
Develop communication plans and strategies	Learn Object Oriented Analysis and Design (OOAD) approach to modeling systems, and compare with conventional Structured Systems Analysis and Design (SSAD) approach
Assess and mitigate project risks	Use Unified Modeling Language (UML) as a tool for information systems modeling
Develop and manage IT project documentation	Manage requirements analysis and other user related issues
Managing project team interactions	Undertake ISAD projects in a virtual team environment

Table 2: Required Deliverables from Virtual Teams

Artifact	MDI A Teams for the Virtual Team Projects	MDI B Teams for the Virtual Projects	MDI B Teams for the Co-located Projects	MU Teams for the Virtual team Projects
Vision document	×	×	×	
Use Case Diagram	×	×	×	
Use Case Specifications	×	×	×	
Supplementary Specifications	×	×	×	
Glossary	×	×	×	
Screen shots	×	×	×	
Class Diagram	×	×		
Sequence Diagram	×	×		
Development Status Report	×			
Project Charter				×
Project Schedules and Resource Allocation				×
Communication Plans				×
Risk Assessment				×
Contingency Plans				×
Weekly Project Status Report (to the Instructors)				×
Project Closure Report				×
Team A and B Assessment				×

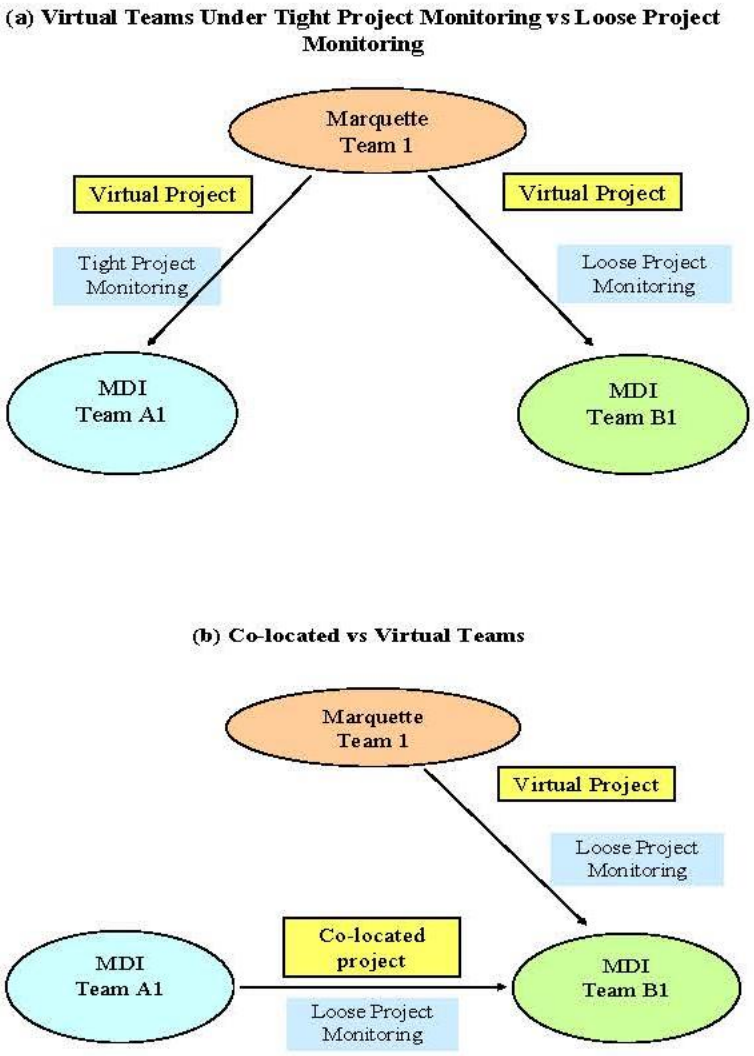
Table 3: ANOVA Results of Various Measures

Variables	Mean (MU Teams)	Mean (MDI Teams)	F (p)
Motivation	5.96	5.93	0.018 (0.893)
Comfort	5.79	5.86	0.082 (0.776)
Learning	6.24	5.89	2.308 (0.135)

Table 4. Critical Factors for Global Software Classroom Initiative

Success Factors
Faculty Level Factors
• Faculty must have shared vision and objectives. • Faculty must experience virtual work to relate to student experiences. • Communication between faculty must be defined, frequent, and clear. • Faculty must complement each other's competencies and roles. • Faculty must demonstrate commitment and enthusiasm. • Faculty must actively manage student expectations
Student Level Factors
• Allow virtual teams to socialize. • Provide opportunities for self-reflection and self-correction. • Individual characteristics can have an impact on team motivation. • Cultural and time zone similarities/differences should be made active part of class discussions.
Technological Factors
• Fit technology to task and work styles. • Anticipate and mange technological risks. • Students must be trained to use technologies for task accomplishment.
Class Constructs
• Constrain project size to enable varied levels of learning. • Virtual team roles should be complementary not competitive. • Create an environment of partnership.
Recommendations for Future Undertakings – Anticipated Success Factors
• Institutions must share vision for undertaking and provide support for faculty level initiatives • Incorporate media-rich technologies for effective communication

Figure 1: Structure of Virtual Project Teams at MDI and MU



Proceedings of the ACM SIGMIS Computer Personnel Research, (2007): pg. 20-27. DOI.