Instructor or Project Manager:
What is the Right Balance as Software Engineering Education Goes Global?

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Abstract – **This paper reflects upon three years of experience of running Global Software Development projects for students distributed across three countries. The paper focuses almost exclusively on the instructors' perspective of such projects and articulates the various Project Management concerns that instructors from the participating institutions need to consider and agree upon to both collaborate on such an international initiative and to run the constituent student projects. Each decision made has implications for instructor workload, institutional relationships and the kind of pedagogical experience that students will receive. The paper uses the Project Management Body of Knowledge as a framework through which to delineate the concerns and types of decision that need to be taken, to explain some of the challenges we faced and strategies we developed to overcome them. The paper seeks to provide guidance to other instructors who are considering the Global Software Development path for their student Software Engineering projects, based upon our experiences of uniting over one hundred students and seven instructors, and suggests critical questions that need to be examined *a priori* to any such new effort.**

Index Terms – Global Software Development, Project Management, Software Engineering Education.

INTRODUCTION

This paper focuses on the role of instructors as they move from assigning Software Engineering projects where students are co-located to projects where students are distributed across time zones and diverse cultures. It reports on three years of experience in running Global Software Development (GSD) projects between seven instructors from institutions in the U.S., Cambodia and India, resulting in ten group projects each comprising eight to ten students and one integrated project comprising thirty-six students.

An instructor can play numerous roles on a project and is clearly instrumental in preparing the set-up and planning the educational outcomes. With increasing distribution and complexity, the tendency is for instructors to take on incredible Project Management and daily logistical responsibilities to the extent they became integral team members. The student experience consequently changes as this instructor role transforms to meet the demands of global working, impacting the nature of the learning experience. There is a balance between exercising so much instructor control that students have little opportunity to learn required tasks and providing so much freedom that students are overwhelmed by choices. Equally critical is the distribution of responsibilities amongst the instructors. The paper consequently highlights two important questions for Software Engineering education: *(Q1)* How much of the planning and management activity should be assumed by instructors and how much should be relinquished to students? *(Q2)* Where should the responsibility for overall project coordination lie? The different answers to these questions need attention in globally distributed contexts if intended learning objectives are to be realized and long-term relationships are to be sustained.

This paper thus attempts to articulate the nature of these managerial and pedagogical trade-offs, and describes how working arrangements have been negotiated and evolved over three years to form an educational model that is permitting an even more ambitious project for our fourth-year of collaboration. The seven participating instructors maintained detailed records and conducted retrospectives throughout the years of their collaboration, and all students completed weekly and pre-/post-project questionnaires. We draw upon these collected data in preparing this paper.

In this paper, we first provide some background to our GSD initiative and refer readers to supporting papers. We then outline some of the instructor-related challenges we have identified, at a high-level, motivating the theme of this paper. The following section comprises the bulk of the paper and considers the challenges in more detail. We use the Project Management Body of Knowledge [1] framework to give a coherent structure to the presentation of these managerial concerns and our explanations as to how we addressed them. This leads to a couple of short sections designed to examine what we consider to be two critical questions that lead to important trade-offs in the nature of the educational experience received by the students and to the potential longevity of the instructor and institutional collaboration. We finish the paper with a list of what we jointly agree to be the top ten questions that instructors need to ask themselves before embarking on a GSD initiative for students and we summarize our current GSD work.

BACKGROUND

Undergraduate Computer Science students at Pace University in the U.S. have been collaborating with undergraduate Computer Science students from the Institute of Technology of Cambodia (ITC) for three years. This collaboration takes the form of an annual GSD project for their capstone Software Engineering courses. Within these projects, the Cambodian students typically act as clients and testers for the project, and the U.S. students typically act as developers. This permits the students to experience a reversal of traditional offshore outsourcing software development roles and thus gain first hand experience of the needs of the stakeholder roles that they are likely to collaborate with when they work in an industrial setting. Over the past two years of the international collaboration, this arrangement has also involved graduate Computer Science students from the University of Delhi in India playing a more recognized role for Indian practitioners of offshore third-party service providers.

Throughout the three years of the initiative, we have been examining the nature of the roles that students will play in the global market place to prepare students with the requisite skills and sensitivities. In addition, we have been exploring the processes and communication models that are useful to employ in this context, along with the tools that can be used to support them. The findings from these three years of work have been reported in previous papers [2-7].

CHALLENGES

It is now quite common to set up a GSD experience for students as part of their Software Engineering training in an undergraduate Computer Science degree. It is not possible to list all contributions here, but our work is obviously part of a growing trend [8-11]. While the papers reporting on these experiences are now increasing in number, they tend to focus on the student perspective, outlining the educational goals and objectives, and then reporting on their attainment or otherwise. It is far less common to examine such projects from the instructors' perspective. Such projects are often extremely high-risk and time consuming for all the parties involved, involving many tasks behind the scenes, so not an endeavor to embark upon lightly or without gaining the benefit of other instructors' insights. This paper is a first attempt to articulate some of the challenges that we as instructors have faced over the three years of running such projects, along with the kind of decisions that typically need to be taken to help these projects run smoothly.

The first time a student project of this nature is undertaken by collaborating institutions, there is a steep learning curve for the instructors involved, and a number of constraints and logistical steps can easily be overlooked as assumptions are made about each side. The first year is much about discovering a model for working that fits all parties, both instructors and students, spanning time zones, places and cultures (see [2, 3] for year one). Such learning experiences can help provide for a more streamlined second year, in turn allowing for the exploration of particular Software Engineering practices or working arrangements amongst the students. For example, outsourcing the development of a well-defined software component to one country and then integrating it into an evolving software system (see [4] for year two). Necessarily, the overall model for collaboration still develops as new information is uncovered, but an agreed and repeatable approach for running global projects can gradually emerge.

Following the first two years of experience, however, we realized that we were focusing a large amount of time and effort on the logistics of the project, meaning that the timely completion of 'some form' of software product by the end of the project became more central at 'crunch time' than the quality of what was produced. It can be convenient for busy instructors, as well as gratifying for beleaguered students, to see something demonstrable, whatever the quality. Engineered to achieve a grade, little consideration often gets given to actual deployment and through-life concerns. We therefore focused on techniques to promote Software Quality Assurance practices in the third year, engaging graduate students to assist the instructors, and we attempted to extend engineering into integration and deployment issues (see [5-7] for year three).

In addition to challenges from an educational perspective, there are many outstanding research challenges with global settings for Software Engineering [12]. We present our experiences and recommendations in the anticipation that they have more general relevance and applicability to educators and practitioners of GSD.

PMBoK FOR INSTRUCTORS OF GSD

The Project Management Body of Knowledge (PMBOK) is an attempt by the Project Management Institute (PMI) to document and standardize accepted Project Management information and practices that are *"generally recognized as good practice on most projects, most of the time",* including software development projects [1]. We use the terminology of the PMBOK to outline in more detail the challenges that instructors need to address on both an initiative and project-by-project basis, and to describe some of the strategies we evolved for tackling them. We do this in recognition that the majority of the issues we discussed over the course of the years were actually more Project Management-related than technical. We were Computer Science and Software Engineering faculty, not experienced Project Managers, so we needed some structure to think about our project planning, execution and control at various levels.

The PMBOK recognizes forty-four processes that fall into five process groups and nine knowledge areas. We use the process groups to delineate those Project Management concerns associated with setting up and running an annual GSD initiative across institutions and the knowledge areas to articulate project-by-project concerns that need attention for every individual student project therein. We refer to these as PMBOK basics for GSD educators (PMBOK-ED).

PMBOK-ED for Institutional GSD Initiatives

Initiating. *"Defines and authorizes the project or a project phase"* [1]. It is essential to ensure that all the instructors have the support of their institution to participate in the GDS initiative and that this commitment is visible. We encountered problems and delays when we did not go through the appropriate channels. A formal agreement helps to start these relationships off in the 'proper' manner. This involves stating who will be involved in what capacities, negotiating the goals of the project (from the pedagogical perspective of every side), understanding the constraints likely to impact the project in different locales and a preliminary statement of scope (with available resources, timeline and deliverables). We found these engagement activities worked more smoothly where there were prior relationships between the instructors at the participating institutions, and this improved every year as additional relationships and commitments became forged between the institutions and instructors. We do not recommend embarking upon such an initiative without following the required protocols of the institutions and unless this personal bond and commitment is initially very strong.

Planning. *"Defines and refines objectives, and plans the course of action required to attain the objectives and scope that the project was undertaken to address"* [1]. Given the fact that student projects run for fourteen weeks, and that most of the students are experiencing their first Software Engineering course, planning needs to be done ahead of time to ensure the project experience complements class sessions and accounts for developing skill sets. 'Rolling wave planning' has the tendency to confuse and introduce delays given the timing. Each year, we found that travel was required to get the participating instructors together to decide upon the nature of the project(s) to work on, to examine the technological environment available to students, to meet the students and assess their skills and interests, and so to establish the most appropriate roles and responsibilities for the students and locations. This then requires more detailed preparation of project descriptions, desired outcomes, milestones, and agreement on processes, technologies and assessment. All these factors are variable from year to year and require coordination given the fact that semesters do not align and national holidays rarely coincide. Planning so as to ensure participating institutions integrate efforts and come together by an agreed date across concurrent project efforts is a core Project Management skill. We do not recommend embarking upon such an initiative without spending time to get to know the students, institutions and instructors' educational objectives, and finding the time to work up a detailed and mutually beneficial plan and management arrangement for the overall initiative before launching any individual projects; buy-in during the planning process is critical.

Executing. *"Integrates people and other resources to carry out the project management plan for the project"* [1]. Completing the work defined in the plans means undertaking all those activities necessary to launch individual projects, assembling extended global teams and then seeing things through to completion. Different instructors often need to emphasize special topics in their courses and this is where we have found that sound prior planning is essential to permit for this flexibility within the context of a more stable and shared global framework. The key is to be adaptive and flexible in execution choices as there are invariably a number of crises. We have found the main issue to be sustaining instructor involvement throughout the initiative. The need to focus on the early planning and on getting teams started is apparent, but once things are moving along, ongoing instructor involvement may not seem so urgent. Any fall-off in instructor involvement can impact the overall initiative negatively unless some management effort is sustained, especially during these un-seemingly fragile times on a project.

Controlling and Monitoring. *"Regularly measures and monitors progress to identify variances from the project management plan so that corrective action can be taken when necessary to meet project objectives"* [1]. This is probably the largest challenge we have faced over the three years. Instructors need to follow the efforts of students very closely when there are dependencies across countries and this demands visibility. We have used many kinds of information dissemination strategy in an attempt to gain early indication of potential problems so we can instigate appropriate and timely mitigation, and have converged on the use of shared wikis, group mailing lists and videotaped team updates to share across the globe. The inevitable issue is one that still affects most software development projects – products delivered with incomplete functionality, even where projects are considered initially small and manageable in scope. Instructors setting projects for GSD need to factor in the cost and time of international communication and coordination; large team sizes do not mean larger projects when these team members are distributed. We recommend modest ambitions and potentially the use of a phased structure for more substantive projects that can carry efforts across semester sessions and wider GSD initiatives.

Closing. *"Formalizes acceptance of the product, service or result and brings the project or a project phase to an orderly end"* [1]. This is the often forgotten part of any initiative. Once the semester is over and the grades are in, it is difficult to lure students back to deal with project completion issues, in some countries more than others. As part of the project wrap-up, we take care to issue students with certificates outlining their participation in a global project, and such certificates take on value in countries like India – it is the experience that many employers are looking for and which sets students apart. Another important wrap-up activity is to spend the time to give a fair assessment of the work of all the parties and not simply to assign a grade to one's own students. Such a critique needs to be objective and considered, because these are the students of your colleagues, instructors who have worked hard to put this initiative together to benefit all sides. This is also

appreciated differently in the three countries, and is particularly important to the Indian students, so much so that they were willing to meet one of the U.S. instructors after one project to gain feedback. It can be equally difficult for instructors to spend the time to tie-up lose ends and conduct a global retrospective when plans for the next semester are already underway. This is a real dilemma for young instructors who are not generally assessed in terms of their global contribution to education. We recommend that closure always be formally planned for if the experience and lessons are to be leveraged in future initiatives.

PMBOK-ED FOR INDIVIDUAL GSD PROJECTS

Project Integration Management. Multiple parties working on distinct parts of a larger project need to come together at some agreed time. The issue of integration was not pressing with a two-party client/developer relationship between the U.S. and Cambodia, but in extending the model to include third-party suppliers in India, integration issues became more apparent [7]. We found the challenges were more to do with the need for students to establish trust in each other than in technology competence. From an instructors' perspective, we saw that social and cultural integration need to be emphasized to form a foundation within which project and technical integration can happen. This is, of course, predicated on an overall project plan showing how the project activities are to come together.

Project Scope Management. Scope is one of the major challenges to ambitious student projects of this nature. Given the fact that a considerable amount of effort is commonly dedicated to satisfying ones own requirements on a typical co-located student project, it is difficult for instructors to see a large proportion of this 'technical skills development' time now get spent on communicating with a party overseas to determine their requirements. Due to the overheads, less can be realistically achieved from a technical perspective and this needs to be taken into account by an instructor who may have grand technical learning objectives for his/her students. It is the instructors' responsibility to design a project that the students have some likelihood of completing satisfactorily and they need to find time to educate on the 'softer skills'.

Project Time Management. Country-specific matters relating to time zones, including changes in time differences during the course of a semester, are a challenge. This is compounded by differing start and end dates for semesters, class schedules, course sequences and expected class loads, as well as exam dates and national holidays. The sequence of activities and milestones for all locations needs to factor in all these constraints and be negotiated collaboratively. We have found them best provided in a single 'live' document with dependencies made clear. In most locations, students find it easiest to work on their projects late at night after classes, which is a preference that is not going to suit one of the parties on a global project where there is a twelve-hour time difference. We have found it helpful to

orchestrate predefined times for students to communicate when synchronicity is needed and to establish protocols.

Project Cost Management. There was a very small budget for each year of the project to support socialization activities and communications. In particular, Cambodian students were responsible for an Internet spend budget and reported on the use of the money. This was not an issue.

Project Quality Management. Over the period of three years, we explored models through which graduates and undergraduates from the three countries could work together, with pedagogical value to all sides, to relieve some of the instructors' tasks. In 2007, we converged on using Software Quality Assurance as a focal point around which to establish a partnering and mentoring relationship [6]. We included U.S. graduate students to help assure the quality of what was to be a single distributed project involving across the three locations. A team of these graduates acted as internal quality assurance mentors for the U.S. undergraduates and another team acted as external quality assurance auditors for the overall project. We found creating a quality support network for these students a viable model to explore further and we are doing so in 2008 [13].

Project Human Resource Management. The student population across locations is rarely even. Preliminary work is required on the instructors' behalf to understand the educational and technical backgrounds of the students, as well as the social and cultural backgrounds. It is necessary to determine what skills students can bring to the project and where training is needed. In managing the resources, it is necessary to place students in the most appropriate roles. We took care to empower the Cambodians as clients and decision makers, and to exploit the expertise of the Indian students in the development supply chain. Within teams, clear global roles and responsibilities need to be assigned to students (e.g., project leader, communications leader, etc.) An important element of human resource management we have found is getting all our students to learn more about each other (i.e., schools, countries, cultures, languages, etc.) Accordingly, we place great emphasis on the organization of bonding activities as a cornerstone to establishing a student connection and lasting social relations. This includes visits to Cambodian and Indian restaurants for U.S. students, country-specific goodies for all students, coupled with map and video production exercises, amongst other activities.

Project Communications Management. It is unrealistic to expect that communication is going to be straightforward across three geographically distributed and technologically uneven locations, especially involving students, since communication is a major reported problem with GSD even in mature industries [12]. Typical problems we faced included Internet access and electricity outage but, after the first year, we began to account for these uncertainties. Another obvious issue is the discrepancy in level of use of the English language, and so the need for instructors to foster an environment amongst the students that promotes confidence and patience in exchanges. As mentioned earlier, artifacts were shared using wikis for

global visibility, but this did require much training and encouragement to be successful in some locations.

Project Risk Management. Each project needs to start with an analysis of its risks. On GSD projects, these risks span country-specific resources and process coordination. Most risks that needed to be addressed on projects were associated with communication and the late reporting of problems, including delays. Also, many things that were considered obvious on one side were not so obvious on the other sides, amongst instructors as well as students. We instituted an instructor blog to help track and resolve issues.

Project Procurement Management. Procurement applies in as much as it is critical to set up an appropriate development and communication process and tools environment for the students from amongst what exists locally or within the open source community [5]. Since we organized our projects to include outsourced components, students also gained a procurement experience. This was conducted using formal Request For Proposal letters, criterion for bid assessment, response letters and contracts.

BALANCING INSTRUCTOR/STUDENT RESPONSIBILITIES

Q1. How much of the planning and management activity should be assumed by instructors and how much relinquished to students?

We focus on creating the overarching plans and logistics for the GSD initiative in general, and letting students plan (within globally agreed constraints) their own courses of action on individual projects. Once projects are underway, however, we have found that it is inevitable that instructors end up monitoring emails and chats, and checking that wikis are up to date with project artifacts. This is especially the case when there are global dependencies, so to ensure that the necessary protocols are being followed, to check if meetings are taking place, to determine who is really working and to assess whether deadlines are likely to be met. We have found that this can become all consuming when there are multiple concurrent GSD projects.

The urge to intervene and chase students, to get things under control and projects out of jeopardy, can get very strong. The dilemma is that monitoring students' tasks on a daily basis can overload the instructors, but not doing so can mean that critical things slip if the students do not share the importance and desire the same outcomes from the work. Consequently, it is tempting for instructors to then provide too much guidance, too much structure and too much control. We find this to be a perpetual challenge requiring a delicate balance. This can be relieved somewhat with the appointment of an explicit and strong student acting as a Project Manager, but this is a role that deserves more credit.

BALANCING OVERALL PROJECT COORDINATION

Q2. Where should the responsibility for overall project coordination lie?

An ongoing challenge we faced was creating an environment in which all the instructors felt like equal partners. During the first year of the initiative, communications started extremely well and phone calls were regular between instructors, but then when other demands impinged on time and a perception was formed of too much control being assumed by a single instructor, the communications became uneven and frustrations arose. This problem was exacerbated in the second year of the initiative when one location involved three separate instructors whose communication also gradually declined. It is important to take the time to understand the backgrounds and motivations of the instructors as well as the students, as well as to know your own. In Cambodia, the instructors are typically on a short-term teaching engagement prior to studying abroad for a doctorate. Personal motivations will take priority under such arrangements and it has thus been hardest to form an institutional memory for the initiative within this location more so than in the other locations.

Over the course of the three years, it has evolved such that the overall Project Management responsibility became the responsibility of the side where the software was to be developed and assembled (the U.S.). Of course, on the Indian and Cambodian sides, instructors were also Project Managers for their location, but one country needed to maintain an integrative view to ease coordination.

TEN KEY QUESTIONS FOR INSTRUCTORS

Before embarking upon GSD for students, there are a number of questions that instructors need to ask themselves:

1. How strong is your existing relationship and long-term commitment to the other institutions and instructors? If you have no prior collaboration and are only in it for the short-term, rethink your motivation. Such projects need to be a team-shared endeavor.
2. Can you delegate and trust the other parties to do their job? The task is forbiddingly arduous for those instructors who cannot do this and the perception of interference can become very real. Roles and responsibilities must be agreed and maintained.
3. Are you prepared to give your time to benefit all the students participating in the project, and not just focus solely on your own students? Instructors who cannot look outwards and care passionately about the learning of all the students across the globe are going to have a difficult time with GSD projects.
4. Will you work to find a schedule that is agreeable by all? GSD projects are necessarily about compromise. It is not going to be possible to have tight control and achieve exactly those learning objectives as when a course is entirely under your control. Instructors who cannot adapt to the needs and situation in other locales will struggle, so only consider GSD if you have the flexibility to go where the projects need you to go.
5. Are you aware of your assumptions? Incorrect assumptions are the most difficult things to account for once GSD projects are underway. Do the students and instructors have the requisite knowledge and, if not, are you prepared to work with the existing skills, or to help teach and mentor others? If access to technology and resources is uneven across the participating institutions, are you ready to find a way to work within the constraints of the lowest common denominator?
6. How much time can you realistically dedicate to the GSD projects? If you are not going to be able to be responsive in a way that is acceptable to all sides, perhaps you should not bother. A week's delay in responding to a request from either an instructor or a student erodes trust, and can kills morale and a project.
7. How are you under pressure? The stress placed on a GSD team can far outweigh that of a co-located team as students learn to deal with situations in which they must relinquish control and trust others. You are going to need to deal with the occasional crisis and play a persistent role managing expectations and perceptions.
8. What are your global predispositions? You need partnerships based on respect and understanding. If you do not spend the time to learn about other countries and cultures, your students won't either.

9. What is your motivation -- what do **you** want to learn about GSD from the experience? It you have no personal goals and objectives, what will keep you interested rather than frustrated at the work?

10. Are you a reluctant Project Manager? Instructors need to master some of the repertoire of Project Management. The more planning that goes into creating an environment for the project and alignment of milestones the better. Just enough structure and control will provide the opportunity to be flexible locally.

OUR CURRENT WORK

In 2007, we brought U.S., Cambodian and Indian students together to work on a single project [5-7]. However, this software system did not get completed due to time delays in compiling the initial requirements and then due to design integration problems. Since the developers were not able to develop all the high priority requirements, and because the requirements were still evolving as the students learned more, the Cambodian clients did not accept the final software to deploy. Currently in 2008, we have a project underway to re-examine the requirements, re-design the system and to take this project through to completion. We are doing this in an original manner that involves graduate support networks and friendly competition. It also involves students from Thailand, a second Cambodian school and professionals from a New York City bank. This project is outlined in [13]. We attribute our ability to take on such an ambitious project to the lessons and protocols we have established and evolved over the previous three years.

CONCLUSIONS

Taking the decision to set up and run student GSD projects is not a matter to be taken lightly. All the trials and tribulations of running a traditional co-located software development project within a single institution are escalated. The question: *"Instructor or Project Manager: What is the Right Balance as Software Engineering Education Goes Global?"* does not lend itself to a simple answer. It is obvious that an instructor needs to know something about Project Management to survive and thrive on such projects, as their capacity to consider all the interrelated aspects ahead of time leads to a far smoother and more rewarding experience. Only once these considerations are articulated and understood, is it possible to examine how students from within the participating institutions (distinct from those who are the primary targets of the educational experience) can get involved and help share some of the instructors' tasks. Students taking specialist degrees in Software Engineering and Project Management can certainly help, as we have begun to explore in [13] and, in this way, the educational experience of GSD can be extended to other constituents.

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REFERENCES

[1] Project Management Institute, Inc. "*A Guide to the Project Management Body of Knowledge*", 3rd Edition (PMBOK® Guide). PMI Publications, 2004.

[2] Gotel, O., Scharff, C. and Seng, S. "Incubating the Next Generation of Offshore Outsourcing Entrepreneurs". In *Proc. Symposium on Information Technology and Entrepreneurship (ITE 2005),* Oklahoma City, USA, April 19-20, 2005.

[3] Gotel, O., Scharff, C. and Seng, S. "Preparing Computer Science Students for Global Software Development". In *Proc. 36th IEEE Annual Frontiers in Education Conf. Borders: Intl, Social & Cultural (FIE 2006),* San Diego, California, USA, October 28-31, 2006.

[4] Gotel, O., Kulkarni, V., Neak, L., Scharff, C. and Seng, S. "Introducing Global Supply Chains into Software Engineering Education". In *Proc. 1st Intl. Conf. on Software Engineering Approaches For Offshore and Outsourced Development (SEAFOOD 2007)*, Zurich, Switzerland, February 5-6, 2007.

[5] Gotel, O., Kulkarni, V., Neak, L. and Scharff, C. "Working Across Borders: Overcoming Culturally-Based Technology Challenges in Student Global Software Development". In *Proc. 21st Conf. on Software Engineering Education and Training (CSEE&T 2008)*, Charleston, South Carolina, USA, April 14-17, 2008.

[6] Gotel, O., Kulkarni, V., Neak, L. and Scharff, C. "Students as Partners and Students as Mentors: An Educational Model for Quality Assurance in Global Software Development". In *Proc. 2nd Intl. Conf. on Software Engineering Approaches For Offshore and Outsourced Development (SEAFOOD 2008)*, Zurich, Switzerland, July 3-4, 2008.

[7] Gotel, O., Kulkarni, V., Neak, L. and Scharff, C. "Integration Starts on Day One in Global Software Development Projects". In *Proc. 3rd Intl. Conf. on Global Software Engineering (ICGSE 2008)*, Bangalore, India, August 17-20, 2008.

[8] Damian, D., Hadwin, A. and Al-Ani, B. "Instructional Design and Assessment Strategies for Teaching Global Software Development: A Framework". In *Proc. 28th Intl. Conf. on Software Engineering (ICSE 2006)*, Shanghai, China, May 20-28, 2006.

[9] Hawthorne, M. J. and Perry, D. E. "Software Engineering Education in the Era of Outsourcing, Distributed Development Distributed Development, and Open Source Software: Challenges and Opportunities". In *Proc. 27th Intl. Conf. on Software Engineering (ICSE 2005)*, St. Louis, Missouri, USA, May 15-21, 2005.

[10] Richardson, I., Milewski, E., Keil, P. and Mullick, N. "Distributed Development – an Education Perspective on the Global Studio Project". In *Proc. 28th Intl. Conf. on Software Engineering*, Shanghai, China, May 20-28, 2006.

[11] Petkovic, D., Thompson, G. and Todtenhoefer, R. "Teaching Practical Software Engineering and Global Software Engineering: Evaluation and Comparison. In *Proc. 11th Annual SIGCSE Conf. on Innovation and Technology in Computer Science Education (ITiCSE'06)*, Bologna, Italy, June 26-28, 2006.

[12] Herbsleb, J. D. "Global Software Engineering: The Future of Socio-technical Coordination". In *Proc. 29th Intl. Conf. on Software Engineering – The Future of Software Engineering (ICSE-FASE 2007)*, Minneapolis, Minnesota, USA, 20-26 May, 2007.

[13] Gotel, O., Kulkarni, V., Say, M., Scharff, C., Sunetnanta, T., Touch, S. and Des, P. "Quality-Driven Competition: Uniting Undergraduates, Graduates and Professionals on Global Software Development Projects". In *Proc. 21st Conf. on Software Engineering Education and Training – Workshop on The Roles of Student Projects and Work Experience in Undergraduate and Taught Postgraduate Programmes,* Charleston, South Carolina, USA, April 14-17, 2008.

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