Preparing Computer Science Students for Global Software Development

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Outline

- IT Offshore Outsourcing
- Issues for CS Education and CS Students
- Responding to IT Offshore Outsourcing
- Our Response: Providing Students with IT Offshore Outsourcing Software Development Experience
  - Preparation
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  - Some findings
- Future and Broader Work
IT Offshore Outsourcing
Issues for CS Education and CS Students

- Decline in CS enrollment
- Entry-level jobs migrating to service-providing countries
- We can NO more prepare students for the *dotcom* world
  - What technical and “softer” skills will students need to develop to work and communicate as productive members of a multi-cultural software development team?
  - What roles will students play in a global market place?
Responding to IT Offshore Outsourcing

- Provide real-life Offshore Outsourcing software development experiences by collaborating with institutions outside of the United States
  - Provide a balanced and first-hand view of the advantages, disadvantages and potential of IT Offshore Outsourcing
- Understand the skills students require to be productive in Offshore Outsourcing software development
  - Examine the ways in which students organize themselves and communicate
Our Response

- Collaboration between Pace University in the US and Institute of Technology of Cambodia (ITC), Phnom Penh
- Simulating Offshore Outsourcing in the classroom in software engineering capstone courses
Arrangements Prior to Semester

- Discussions/agreement with corresponding professor
  - Country, culture, school system
  - Students’ background
  - Internet access
  - Creation of syllabi
  - Projects
  - Tools/software engineering practices to be used

- Choice of communication tools (emails, chats, blogs, mailing lists, etc.) and definition of a protocol for communication between professors, students, students/professors

- Definition of roles for students/professors
Setup: Projects

- Project 1: ITC Schedule Builder and Classroom Assignment System
  - Generate/view schedule and classroom assignments and availabilities w.r.t. existing courses and faculty preferences

- Project 2: ITC Student Information System
  - Student registration management
  - View student information
  - Grades, course, attendance management
  - Provide statistical results

- Constraints
  - Standards and protocols (software process, documentation, coding, communication)
  - Use of Java, JDBC, Java Servlets, Oracle, Eclipse
Setup: Project Milestones

- Team bonding and initialization of communications (1 week)
- Requirements (5 weeks)
- Design (4 weeks)
- Mid-semester presentations
- Implementation (2 weeks)
- Testing (2 weeks)
- Presentations (Last week of class)
Setup: Teams & Communications

- 5 teams, 19 Pace students, 13 ITC students
  - Students choose their teams
  - Projects assigned to teams
- Extended teams: Reversal of traditional roles
  - Customers/end-users in Cambodia (2-3 students)
  - Developers in the US (3-4 students)
- Communications
  - How? Chats (AOL instant messenger), emails (mailing-lists), face-to-face meetings (local teams)
  - Initialization of communications (first week of class)
Setup: Roles & Responsibilities

- US students:
  - “Capture” the requirements,
  - Propose design options
  - Implement the software, Test the software
  - Handle requirements changes and integrate feedback
  - Deliver software for their client
  - Report on the ITC team
  - Answer a weekly questionnaire
  - Maintain a web page for the project, maintain a blog, save all chats, archive emails
  - Describe and reflect on the software engineering process and communication protocol followed
  - Present their work professionally
  - Demonstrate their software
Setup: Roles & Responsibilities

Cambodian students:

- Describe environment/problem/software
- Review and give feedback on requirements, design and testing documents
- Test the software
- Report on the Pace team
- Answer a weekly questionnaire
- Accept or reject the software
- Present their experience
- Demonstrate the software
How to Monitor Students’ Work?

- Strict deadlines
- Regular deliveries (with review/feedback and iteration)
- Weekly recording of communications of local and extended teams using an online questionnaire
- Maintain blogs, archive emails, save chats
- Interviews of the students by professor and external evaluator
- Reflections on the software engineering and communication processes
Communication Questionnaire

- To record chats, emails, face-to-face meetings weekly
- When did the communication take place?
- Between whom did the communication take place?
- What was the main topic of the communication?
- Was the communication more on planning, checking or a mixture of both planning/checking?
- Was the communication useful or not?
- Use of http://www.questionpro.com
Findings: Learning Experience

- Software engineering and project-based learning
- Multicultural experience
  - Seriousness/motivation of other students
- Involvement of a client
  - Accountability
  - Negotiation
  - Pride
- Experience reflects a typical IT Offshore Outsourcing scenario (albeit reversal of traditional roles)
  - Balanced perspective coming out
Findings: Realities

- Availability of clients/developers
  - Assumptions made by developers
  - Accounting for multiple-perspectives
- Very demanding client
  - Changes in requirements
  - Addition of functional requirements
- Discussion on requirements, little on testing and quality
- Coordination (time, semester/trimester, vacations)
- Dividing time between setting up infrastructure and doing intellectual work (not scalable, evolvable, agile friendly)
- Language/cultural barrier
Findings: Communication

- Emails > Face-to-face > Chats
- Emails many-to-many or through a mediator
  - Best project was only group to use mediator model
- Emails sent to local or extended team, not individual
- Emails equally used for checking/planning
- Chats took place mainly between 9 pm and 12 am
- Chats used more for checking (asking questions/feedback)
- Less chats as project proceeded
  - Most of the checking related to requirements
- Students discuss same topics in emails as chats
  - Need for redundant channel?
- Face-to-face meetings used more for planning
Future Work

- In spring 2006 the model was extended to emphasize a global supply chain scenario
  - US students acted as developers and lead contractors
  - ITC students acted as clients, testers and translators
  - University of Delhi students acted as third party suppliers
- Setup for next year:
  - Students will get a flavor of how to initiate and work out ground rules for such projects
  - More social bonding activities
  - All sets of students will experience and learn about the problems and skills associated with the developer side of the IT Offshore Outsourcing equation
  - Study the balance of competition and collaboration on global student projects of this kind
  - Use of more sophisticated collaborative tools
  - Dedicated resource to help students learn and develop as a team
Broader Perspective

- Distributed software development versus co-located software development
  - Dimensions for characterization?
  - Same problems?
  - Differentiating problems?
  - Communication models and processes?
- Requirements and information management
- User involvement
- How to get agile-ready?
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