Keeping Software Engineering Education
Up-to-date with Globally Distributed
Software Development

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http://atlantis.seidenberg.pace.edu/wiki/gsd2008
Outline

- Motivation:
  - Offshore Outsourcing
  - Issues for CS education and CS students
- Our response and vision
- Timeline:
  - 2005 – Pace (UG), ITC
  - 2006 – Pace (UG), ITC, University of Delhi
  - 2007 – Pace (UG, G), ITC, University of Delhi, small companies, NCIIA grant
  - 2008 - Pace (UG, G), bank in New York City, ITC, RUPP, University of Delhi, Mahidol University, NCIIA grant
Offshore Outsourcing
Issues for CS Education and CS Students in the US

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

- Provide real-life Offshore Outsourcing software development experiences:
  - Provide a balanced and first-hand view of the advantages, disadvantages and potential of Offshore Outsourcing
- Understand skills students require to be productive in Offshore Outsourcing software development:
  - What roles will students play in a global market place?
  - What process and communication model works for distributed software development?
- Expose students to realities of global supply chain management:
  - How to divide up a project into component parts for different parties to work on across time zones and cultures?
- Scaling up to large projects:
  - How to deal with RFPs / competition in supply?
  - How to improve and assure the quality of distributed projects?
  - How to develop iteratively?
  - How to integrate work and deploy into a market?
First Step - 2005

Globalization

USA
Managers / Developers

CAMBODIA
Clients
Projects

- **Project 1: ITC Schedule Builder and Classroom Assignment System**
  - Generate schedules and classroom assignments / availabilities w.r.t. faculty preferences

- **Project 2: ITC Students Information System**
  - Register students (for a year)
  - View students information
  - Manage grades
  - Manage courses
  - Manage attendance
  - Provide statistical results

- **Project 3: NON-DISTRIBUTED control project - housing**
Projects

- **Project 1: ITC Library Management System**
  - Support administrators, librarians and patrons
  - Enforce the unique policies of the ITC library

- **Project 2: Cambodian Crafts On-Line Store**
  - Manage the registration of customers, the placement of orders, and the fulfilment and control tasks of service staff

- **Project 3: Cambodian On-line Restaurant**
  - Manage the registration of customers, the placement of orders, and the fulfilment and control tasks of service staff
Setting - 2007

Globalization

Software engineering process

USA
Managers
Developers

Auditors
Mentors

Entrepreneurs

RFP

CAMBODIA
Clients
Testers

INDIA
Sub-Contractors

Technology

Entrepreneurs

RFP

CAMBODIA
Clients
Testers

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CAMBODIA
Clients
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INDIA
Sub-Contractors

Technology
NCIIA Grant 2006-2008

- “Incubating the Next Generation of Global Software Development Entrepreneurs”, National Collegiate Inventors and Innovators Alliance

Background and vision:
- Initial model for running a global software development project integrated within the curriculum of Pace and ITC
- Focus now on the outcomes of the student projects and the longer-term objectives of the learning process (i.e. fruitful business opportunities and alternative career paths for students)
- Enable students to take software products they develop beyond prototype to realize viable commercial products
- Provide insight into how to design and deliver an end-to-end project for a target market using the local knowledge and technical expertise of service-providing third-parties (quality and longevity)
Objectives for 2007

- Educate students as to the entrepreneurial opportunities in the software development field concurrently with the project.
- Give some foundational business skills required to pursue such opportunities (i.e. startups).
- Mentors - A resource to support students in learning about the ‘softer’ skills (e.g. the management, leadership, decision-making and communication skills) necessary to support teamwork and technical assistance.
- Auditors - Emphasize the ‘whole-life’ cost of commercializing software (including SQA, deployment and maintenance).
Single Software Development Project

- MultiLIB - ITC Computer Science Department Library Management System
  - Support students, librarians, professors and administrators
  - Enforce the unique library policy
  - Maintain a holding of different types of resources (e.g. books, CD-ROMs, E-books, videos, and students’ reports)
Extended Teams

- 8 Pace undergraduate students (Software Engineering course)
- 7 Pace graduate students (Software Quality Assurance course)
- 15 ITC undergraduate students (Software Engineering course)
- 6 University of Delhi graduate students (Database Design course)
- 1 assigned project
- 2 extended sub-teams (librarian / admin / professor component and student component) ended up in 1 extended team of 36 students
- Students choose their teams
Milestones

- Initialization of communications and team bonding with gifts and videos (1 week)
- Requirements (5 weeks)
- Design (4 weeks)
- Mid-semester presentations
- Implementation (3 weeks)
- Testing (1 week)
- Final presentations

Software development processes used
Roles & Responsibilities

Cambodian students – Clients and testers:

- Describe environment/problem/software
- Review and give feedback on requirements, design and testing documents
- Test the software and submit bug reports
- Report on the Pace team
- Accept or reject the software
- Compare the software developed in the US and in India
- Implement the software *
- Present their work and experience
- Demonstrate the US software
- Demonstrate their software *
- Manage a budget
Roles & Responsibilities

- Undergraduate US students – Developers and lead contractors:
  - “Capture” the requirements,
  - Propose design options
  - Manage an RFP process *
  - Handle requirements changes and integrate feedback
  - Report on the ITC/Delhi teams
  - Interact with mentors and auditors and integrate feedback *
  - Deliver software for their client
  - Describe and reflect on the software engineering process and communication protocol followed
  - Implement and test the software
  - Present their work and experience
  - Demonstrate their software
Roles & Responsibilities

- Indian students – Third-party suppliers:
  - Answer an RFP *
  - Provide US students with a database design and SQL code to be integrated into the overall system design
  - Report on the US team
  - Implement the software
Roles & Responsibilities

- Graduate US students – Mentors and auditors:
  - Mentors:
    - One graduate advisor assigned to each sub-team
    - One graduate advisor assigned to overall team integration
    - Weekly support structure
    - Coaching with techniques and practices
    - Internal pair of eyes for quality
  - Auditors:
    - Two graduates assigned to SQA in each sub-team
    - Review and report on student work (each deliverable)
    - External quality gate keepers
Communications

- How?
  - Chats (Yahoo instant messenger)
  - Emails (mailing-lists)
  - Face-to-face meetings (local teams)
  - Reflective blogs (team awareness)
  - Wiki (documents)
  - No webcams and voice
Students’ Wikis

- 3 Wikis:
  - 1 for each sub-component:
    - [http://atlantis.seidenberg.pace.edu/wiki/student2007](http://atlantis.seidenberg.pace.edu/wiki/student2007)
    - [http://atlantis.seidenberg.pace.edu/wiki/librarian2007](http://atlantis.seidenberg.pace.edu/wiki/librarian2007)
  - 1 for integration
    - [http://atlantis.seidenberg.pace.edu/wiki/student2007/Pace_Integration](http://atlantis.seidenberg.pace.edu/wiki/student2007/Pace_Integration)

- Contents of the sub-component Wikis:
  - Contact information of the global sub-team and its members
  - Description of the software engineering process followed
  - Requirements, design and testing material
  - PowerPoint and video presentations

- Contents of the integration Wiki:
  - Architecture for the system
  - Database design
  - Feedback on user interface mockups
  - Deployment environment
  - Responsibilities of the team members
  - Integration and system-level testing documentation
Findings: Wikis as the Coordination Backbone of the Project

- Facilitate bonding activities:
  - Pictures, gift exchange and student’s video presentations
- Get up to speed on the project quickly
- Empower students at each location to contribute ideas
- Present the working philosophy to be followed
- Ensure transparency and shared awareness
- Improve progress monitoring
- Promote a better understanding of the software engineering process, practices and tools used in the project
- Increase productivity:
  - Easier to maintain than web pages
  - Turn-around time required to get feedback shorter
  - No claim of lost documents in email exchanges
Findings: Wiki Adoption in Different Countries

- Different levels of exposure to the Internet influence the willingness to use Wiki technology and affect the perception of its potential value
  - Cambodia – Reluctant to use Wikis despite training
  - India and US – Communication tools are more on the periphery than those tools actively used to support development
- Need of more attention to communication tooling than engineering tooling when background exposure to ‘everyday technologies’ is dissimilar
  - More in-depth study necessary
Findings: Wikis as Facilitator of Quality Assurance Activities

- **Mentors:**
  - Internal eyes for the project
  - To raise any early concerns to the teams and instructors

- **Auditors:**
  - External quality gatekeepers
  - To review the artifacts delivered and the processes used to deliver them

- **Wikis permitted instructors/mentors/auditors to:**
  - Have an up-to-date picture of the global project at any one moment in time
  - Track progress
Findings: Students as Partners

- Pace, ITC, University of Delhi students – partnering together and working on one joint project with selected team members
  - Advantages
    - Learning from each other
    - Motivation
    - Accountability
    - Pace undergraduates and graduates got to know each other
    - Pace undergraduates made friends in Cambodia and India
  - Issues
    - Coordination (e.g. Internet, deadlines, class load)
    - Loosing local friends
    - Team unity and cohesion
    - Individuals bypassing team decisions
    - Overlapping document and code versions
Findings: Students as Partners

- Pace graduate – faculty partners
  - Advantages
    - Visibility of the project facilitated by regular reports on undergraduate progress
    - Issues are detected and addressed (e.g. technical training needs, team spirit and management skills)
    - Quality of requirements, design and implementation improved
    - Less need of faculty oversight
  - Issues
    - Feedback not always timely
    - Cycle time for feedback too short
    - Audit planning not carried out
    - Constructing a sufficient audit template
Findings: Students as Mentors

- Pace graduates mentoring Pace undergraduates
  - Advantages
    - Help in goal setting
    - Provide technical training
    - Support structure for the team leaders
    - Provide rationale for process and explain decision consequences
    - Share corporate experience
  - Issues
    - Benefited mainly leaders
    - Limited contact and visibility for non leaders
    - Cycle time for feedback too short
    - Undergraduates uncomfortable being proactive
Spring 2008

- 4 countries (US, Cambodia, India, Thailand) actually implement and deploy the Spring 2007 prototype that needs refinement and iteration
- Cambodian clients sponsor 5 development teams (2 in the US, 1 in India, 1 in Cambodia and 1 in Thailand) to create the system in a competitive manner and are responsible of deploying their selected system
- US graduate students will help refine the requirements with the Cambodian client and will help each development team
- US graduate students will assess the quality of the produced artefacts and the process to develop them
- Various settings to study the impact of time, place, communication patterns and socialization (e.g., in Second Life) on requirements discovery, changes and quality
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