Software Engineering Education Goes Global

Dr. Christelle Scharff
Pace University, USA

Dr. Olly Gotel
New York, USA

http://atlantis.seidenberg.pace.edu/wiki/gsd2007
http://atlantis.seidenberg.pace.edu/wiki/gsd2008
http://atlantis.seidenberg.pace.edu/wiki/gsd2009
http://atlantis.seidenberg.pace.edu/wiki/gsd2010
Collaborators

- Vidya Kulkarni (University of Delhi, India)
- Moniphal Say (Institute of Technology, Cambodia)
- Thanwadee Sunetnanta (Mahidol University, Thailand)
- Longchrea Neak (Institute of Technology, Cambodia)
- Phal Des (Royal University of Phnom Penh, Cambodia)
- Sopheap Seng (Institute of Technology, Cambodia)
Outline

- Scrum
- Objectives
- Motivation
- 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), New York Bank, ITC, RUPP, University of Delhi, Mahidol University, NCIIA grant, Second Life Campus grant
Timeline (continued)

- 2009 – Pace (G), University of Delhi, ESP (Ecole Superieure Polytechnique, Dakar, Senegal), IBM grant
- 2010 – Pace (G), University of Delhi, RUPP, ESP (Ecole Superieure Polytechnique), University of Thies, ESMT (Ecole Superieure Multinational des Telecommunications), IBM grant, NCIIA grant

Related work
Outline

- Guidelines for instructors interested in setting up GSD projects for students
  - Are you ready to be a GSD instructor?
  - How to plan? How to manage? How to close the project?
  - How to sustain?
- A close-up on tools
  - Evolving a tooling infrastructure for development, communication, project management and socialization
  - Experience with IBM Rational Team Concert
Scrum
Scrum

- Developed in management in 1983 and adapted to software development in 1993 by Jeff Sutherland and Ken Schwaber
- Empirical challenges cannot be addressed successfully by generic models
- Focus on maximizing the team’s ability in an agile manner to emerging challenges
- No specific process prescribed
- Short iterations (Sprint) where the software is designed, developed and tested
- Daily 30-minute stand-up meetings (Scrum)
- The requirements are expressed using user stories and available in the Product Backlog
- The Product Owner is the owner of the requirements
- The Scrum Master facilitates Scrum and remove impediments liked with the process
Overview of Scrum

Daily Scrum Meeting

Backlog tasks expanded by team

Sprint Backlog

Product Backlog As prioritized by Product Owner

24 hours

30 days

Potentially Shippable Product Increment

Source: Agile Software Development with Scrum by Ken Schwaber and Mike Beedle, and Cohn

Source: http://www.rallydev.com
Objectives
Objectives

As CSEET presenters

- We want to be able to know who are the attendees and their expectations so that we can better meet attendees' expectations.
- We want to be able to share our 5-year GSD experience so that we can get other faculty interested in embarking in such initiatives.
- We want to be able to provide faculty with a tool to assess if they are GSD-ready so that faculty know what is expected when involved in GSD projects as an instructor.
- We want to be able to provide faculty with guidelines on what to do before, during and after GSD initiatives so that interested faculty can benefit from our experience (good and bad).
- We want to be able to provide faculty with guidelines on how to choose tools to support students' GSD projects so that interested faculty can benefit from our experience (good and bad).
- We want to be able to provide faculty with guidelines on how to sustain GSD projects over time so that it is not a one-time initiative and there is a return on investment.
Audience
Motivation
Offshore Outsourcing
Motivation

- 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 marketplace?
  - What new opportunities arise?
- Provide real-life Offshore Outsourcing software development experiences
  - Provide a balanced and first-hand view of the advantages, disadvantages and potential of Offshore Outsourcing
  - Provide experience in working across time zones, distance and cultures
Related Work
Related Work


Related Work

- Papers at CSEET 2010
2005
Setting for 2005

USA
Managers / Developers

CAMBODIA
Clients

Globalization
Software Development 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**
Setting for 2006

Globalization

Supply Chain

Software Engineering Process

USA
Managers / Developers

CAMBODIA
Clients

INDIA
Sub-Contractors
Software Development 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
2007
Setting for 2007

USA
Managers
Developers
Auditors
Mentors

CAMBODIA
Clients
Testers

INDIA
Sub-Contractors

Globalization
Tooling
Quality
Entrepreneurship
Supply Chain
Software Engineering Process

Pace University
New York Westchester

University of Delhi

ITC

Tooling

Java
MySQL
JUnit
Java.net
Subversion
Yahoo! Groups
Yahoo! Mail
Single Software Development Project

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

Integration
Setting for 2008

- Globalization
- Tooling
- Quality
- Competition
- Socialization
- Deployment

Legend:
G - Graduate students
UG - Undergraduate students

USA
- Team NYC - Developers (5 UG)
- Team PLV - Developers (4 UG)
- Developer quality coaches (5 G)
- Client coaches (5 G)
- Auditors (16 G)
- Professors (2)

INDIA
- Developers (5 G)
- Professor (1)

CAMBODIA
- ITC
  - Clients & Deployment team (5 UG)
  - Developers (4 UG)
  - Professors (2)
- RUPP
  - Socialization team (2 UG)
  - Professor (1)

THAILAND
- Developers (5 UG)
- SQA trainees (4 G)
- Professor (1)

Socialization
Client quality *coaches*  
(5 US graduates)  
to help the client to baseline the requirements, create a versioning and requirements management process, and help prepare for acceptance testing and software selection.

Client  
(5 Cambodian ITC students)  
to manage the requirements and maintain a requirements wiki, and each student sponsors a development team.

**5 development teams**  
**5 versions of the software!**

**US NYC**  
(6 students)  
coaching

**US PLV**  
(4 students)  
socializing

**Thailand**  
(4 students)  
training

**India**  
(5 students)  
coaching

**Cambodia ITC**  
(4 students)  
coaching

**Developer quality *coaches***  
(5 US graduates)  
to help each development team to inject quality into their process and products.

**Socialization team**  
(2 Cambodian RUPP students)  
to help with socialization.

**SQA trainees**  
(4 Thai students)  
to shadow / learn from the coaches and auditors.

**Auditors**  
(16 US graduates and IT professionals)  
to provide early feedback on the requirements, audit each development team and externally test the software delivered. One student is the SQA Manager.

**Requirements (4)**  
**Design / Prototype (4)**  
**Code / Test (6)**  
**Deploy / Maintain (n)**

**Bonding / Setup (2)**  
**Project with SQA (14+ weeks)**

Framework for the Software Development Lifecycle - feedback and iteration triggered by coaching and auditing
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)

*Currently deployed and used at ITC*
2009
Setting for 2009

USA Developers
Product owner (instructor)
Process coach (instructor)

Senegal Developers

India Developers

Distributed Developers
End-to-Eng Tooling
Scrum
Agile Methodologies

Mobile

UNIVERSITY OF DELHI

UNIVERSITY OF Dakar

Rational Team Concert

Google Groups

Google Talk

Java
Software Development Project

- TargetFirstGrade – Product owner: Dr. Scharff
  - Mobile application to be assess the learning of pupils in first grade (5-6 year old) in topics such as Mathematics, Reading, Writing and Geography
  - Delivery of exercises in these topics in the form of open-ended and multiple choice questions
  - Automated computation of the scores
  - SMS of the scores to the parents
Setting for 2010

- USA Developers
- Product owner
- Auditors
- Process coach (instructor)

- Senegal Testers

- India Testers

- Mobile

- Quality
- End-to-End Tooling
- Scrum
- Agile Methodologies

- Pace University
- Esmit
- Université de Tours
- Ecole Supérieure Multinationale des Télécommunications

- git
- maven
- eclipse
- android
- RALLY
- Java
- Google talk
- Google Groups
- Rational Team Concert
Software Development Projects

- **Project 1: No Ink** for Blackberry phones
  - Taking, annotating and organizing notes

- **Project 2: Back Pocket** for basic phones
  - Budgeting for students

- **Project 3: Godiva Flash Cards** for Android phones
  - Social flash cards to revise class topics

End-to-end tooling infrastructure
2005 – 2010
<table>
<thead>
<tr>
<th>Focus</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Globalization</td>
<td>2005 + Software engineering</td>
<td>2006 + Quality, tooling,</td>
<td>2007 –RFP + Deployment,</td>
<td>Distributed developers, Scrum and agile</td>
<td>End-to-end tooling infrastructure, Scrum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>process, supply-chain</td>
<td>integration, entrepreneurship</td>
<td>competition, socialization</td>
<td>and agile methodologies, end-to-end tooling</td>
<td>and agile methodologies, mobile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>management</td>
<td></td>
<td></td>
<td>infrastructure, mobile</td>
<td></td>
</tr>
<tr>
<td>Number of institutions / countries</td>
<td>2 / 2</td>
<td>3 / 3</td>
<td>3 / 3</td>
<td>5 / 4</td>
<td>3/3</td>
<td>5/3</td>
</tr>
<tr>
<td>Number of instructors / students</td>
<td>3 / 32</td>
<td>4 / 33</td>
<td>4 / 34</td>
<td>6 / 60</td>
<td>3/5</td>
<td>1/38</td>
</tr>
<tr>
<td>Number of developed software systems</td>
<td>2 versions of the same software; 3 different software</td>
<td>2 versions of the same software</td>
<td>5 versions of the same software (competition)</td>
<td>1 single software</td>
<td>3 software</td>
<td></td>
</tr>
<tr>
<td>Customer</td>
<td>Cambodian (student)</td>
<td>Cambodian (student)</td>
<td>Cambodia (ITC)</td>
<td>Cambodia (ITC)</td>
<td>US (instructor)</td>
<td>US (students)</td>
</tr>
</tbody>
</table>
The GSD Instructor
Becoming a GSD Instructor

- Plenty of effort required for
  - Setting up and planning
  - Coordinating, running and monitoring
  - Ensuring a happy ending
  - Making the project sustainable

- We provide some guidelines for instructors interested in embarking and sustaining similar initiatives
Are you GSD-Ready?

10 Questions for Instructors
Are you GSD-ready?

1. Do you have existing relationships with other institutions and instructors?

- Yes / No

- If you have no prior collaboration and are only in it for the short-term, try to establish relationships with instructors at conferences

- Such projects need to be a team-shared endeavor
Are you GSD-ready?

- 2. Can you delegate and trust the other parties to do their job?
  - Yes / No

  - If no, the task will be forbiddingly arduous and the perception of interference can become very real
  - Roles and responsibilities must be agreed and maintained
Are you GSD-ready?

3. Are you prepared to give your time to benefit all the students participating in the project?

Yes / No

- Instructors cannot focus solely on their 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
Are you GSD-ready?

- 4. Will you work to find a schedule that is agreeable by all?

- Yes / No

- 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
Are you GSD-ready?

5. Are you aware of your assumptions?

Yes / No

- 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?
Are you GSD-ready?

6. How much time can you realistically dedicate to the GSD projects?

- 1-2 hours / week
- 2-4 hours / week
- 4-6 hours / week
- 6-8 hours / week
- More than 8 hours / week

- 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 4-day delay in responding to a request from either an instructor or a student erodes trust, and can kill morale and a project
Are you GSD-ready?

7. How are you under pressure?

- Very well
- Well
- Average
- Not well
- Not well at all

- 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. This impacts professors.
- You are going to need to deal with the occasional crisis and play a persistent role managing expectations and perceptions
Are you GSD-ready?

8. Did you live or travel intensively in countries with different cultures? (organized tours not included)

Yes / No

- 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
- Experience with other cultures is a plus
Are you GSD-ready?

9. Do you have personal goals and objectives that are making you interested in GSD?

Yes / No

- What do you want to learn about GSD from the experience?
- If you have no personal goals and objectives, what will keep you interested rather than frustrated at the work?
Are you GSD-ready?

10. Do you have Project Manager skills?

Yes / No

- 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
Guidelines for Instructors
Guidelines for Instructors

- Use (or establish) (strong) relationships with instructors at other institutions

- Collect information
  - Instructors (e.g., background and motivations)
  - Students (e.g., background and skills)
  - Institutions (e.g., labs and internet access, and academic calendar)
  - Courses (e.g., syllabi, learning objectives and exams)
  - Countries (e.g., culture and time zone)
Guidelines for Instructors

- Set expectations for each instructor and for the global team of instructors
- Set learning objectives for each course and for the overall project
- Establish governance amongst the instructors
- Assess the risks related to the GSD project
- Select a real project that matters to one of the parties
- Define a GSD scenario that accounts for the different parties and describe the project set-up with objectives, roles, and responsibilities such that students know their rules of engagement
Guidelines for Instructors

- Decide on a software engineering process to be followed
- Break down the project into viable steps with deliverables and check points
- Agree upon (and install) tools for engineering, project management, communication and socialization that accommodate the different backgrounds of the students
- Define your research objectives and set-up data collection instruments
Guidelines for Instructors

- Prepare tutorials and a set of resources for students – preferably videos (e.g., tutorials on process and tools)
- Gather typical objects, movies, music and books from the different locations that may be offered as gifts to the students
- Travel to the locations to meet the instructors and students (highly recommended)
Guidelines for Instructors

- At the beginning of the project
  - Collect the emails and pictures of all the students and match the students to their global teams
  - Create mailing list for each global team and introduce the students to each other
  - Start the project formally by inviting all the students to a social event (e.g., Second Life party or scavenger hunt)
  - Provide the setup scenario and milestones of the project to the students, and publicize their roles and responsibilities within the global team
  - Provide training on tools and process at each location (e.g., XP game)
Guidelines for Instructors

- One month after the beginning of the project
  - Check the familiarity of the students with each others (e.g., team and country awareness)
Guidelines for Instructors

Regularly

• Organize socialization activities (e.g., chats, Second Life and exchange of gifts) to foster team bonding
• Monitor the stress of the students
• Ensure that missed communication sessions are documented and rendered visible for all parties
• Organize some mandatory online meetings for the global teams
• Remind students of deadlines and work items to be delivered
• Re-publicize the roles and responsibilities of the students
• Check that each location is treated as an equal partner
• Monitor students’ progress to detect problems
Guidelines for Instructors

Weekly

- Allow class time to be used by the local teams
- Communicate with students at the other institutions
- Communicate with the instructors at each location
- Update a log that documents what amazed you, what went well and what went wrong on the project
- Provide feedback to the global teams
- Work closely with coaches and auditors such that their help and feedback benefit the students
- Chase for missing work and missed deadlines
Guidelines for Instructors

- In case of problems
  - React quickly as time is crucial and problems can escalate
  - Have contingency plans (e.g., redundant server and communication channels)
Guidelines for Instructors

- Formally close the project with a social event for the students
- Send emails to students to thank them, recognize their work and issue certificates for students to show to potential employers
- Summarize what went well on the project and what didn’t; determine how to improve the model going forward
Tooling Infrastructure
<table>
<thead>
<tr>
<th><strong>Technical</strong></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eclipse IDE with JUnit, MySQL</strong></td>
<td>Eclipse IDE with JUnit and CVS, MySQL</td>
<td>Eclipse IDE with JUnit and subversion, MySQL, java.net for issue tracking</td>
<td>Eclipse IDE with JUnit and subversion (Netbeans - India; Visual Studio – Thailand), DB designer for database, MySQL, java.net for issue tracking</td>
<td>IBM Rational Team Concert for development with Jazz Source Control EclipseME plugin for mobile application development</td>
<td>IBM Rational Team Concert or (Rhomobile, notepad++ and GIT) or (Eclipse IDE, Android plugin and Mercurial)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Communication</strong></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yahoo IM, Yahoo groups, websites, blogs</strong></td>
<td>Yahoo IM, Yahoo groups, websites, blogs</td>
<td>Yahoo IM, Yahoo groups, wikis, blogs, videos</td>
<td>Yahoo IM, Yahoo groups, wikis, wink for video screen capture</td>
<td>Google groups, Gtalk, wikis and notifications in IBM Rational Team Concert, Camstudio for video screen capture</td>
<td>Google groups, wikis in the project management tools</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Socialization</strong></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yahoo IM, exchange of gifts</strong></td>
<td>Yahoo IM, exchange of gifts</td>
<td>Yahoo IM, exchange of gifts, videos</td>
<td>Yahoo IM, socialization exercises, Second Life</td>
<td>GTalk</td>
<td>Face-to-face meetings, Gtalk</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Project management</strong></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Website pages, blogs</strong></td>
<td>Website pages, blogs</td>
<td>Wikis, blogs</td>
<td>Wikis, Google calendars, timezone software</td>
<td>IBM Rational Team Concert to support Scrum, teams and iterations, Google calendars</td>
<td>IBM Rational Team Concert or Redmine or Rally Software</td>
<td></td>
</tr>
</tbody>
</table>
Second Life for Socialization
Choosing the Right Tooling

- Assess the infrastructure situation (e.g., Internet and electricity) in the involved institutions and countries.
- Assess the experience, level of exposure and perception of different tools and tool types by the students:
  - Engineering tools
  - Communication tools
  - Project management tools
  - Socialization tools
- Look around to see what tools could be used on the project.
Choosing the Right Tooling

- Choose a shared consensual tooling infrastructure consistent across locations that accounts for the roles, cultures and levels of exposure of the students.
- Consider an infrastructure that includes engineering, communication, project management and socialization tools.
- Privilege free and open source tools.
- Do not underestimate the power of socialization tools.
- Do not rely on too many tools.
- Prefer communication tools that privilege one-to-many communications.
- Rely on wikis for document sharing.
Choosing the Right Tooling

- Explain the rationale behind the choice of each tool
- Make the tools available for each location (e.g., IT department involvement)
- Provide customized training online and onsite prior to using the tools; the training must end with an evaluation of the proficiency of the students with the tools
- Provide a set of resources, preferably videos, prior to using the tools
- Account for tooling learning curve in the project milestones
Sustainability
Guidelines for Sustainability

- Do you and your collaborators have personal goals and motivation in undertaking a next round of the project?
- Are you and your collaborators still getting along?
- Did you and your collaborators establish a stronger relationship that will permit to share work more efficiently?
- Are you and your collaborators think that you can put work and time and live with pressure and stress again?
- Can you and your collaborators re-use practices and material created in the previous version(s) of the project to build on the invested effort?
Experience with IBM Rational Team Concert
Objectives

- As CSEET presenters
  - We want to be able to know who are the attendees and their expectations so that we can better meet attendees' expectations.
  - We want to be able to share our 5-year GSD experience so that we can get other faculty interested in embarking in such initiatives.
  - We want to be able to provide faculty with a tool to assess if they are GSD-ready so that faculty know what is expected when involved in GSD projects as an instructor.
  - We want to be able to provide faculty with guidelines on what to do before, during and after GSD initiatives so that interested faculty can benefit from our experience (good and bad).
  - We want to be able to provide faculty with guidelines on how to choose tools to support students' GSD projects so that interested faculty can benefit from our experience (good and bad).
  - We want to be able to provide faculty with guidelines on how to sustain GSD projects over time so that it is not a one-time initiative and there is a return on investment.
Thanks

- Students (ITC, Pace, Delhi, Mahidol, ESP, RUPP)
- Faculty (ITC, Pace, Delhi, RUPP)
- David Michael, PR Newswire, New York
- Cedric Mainguy, Asiaform, Phnom Penh
- John Fox, Homeland Energy Inc., New York
- Doug Tidwell, IBM
- Chris Nelson, IBM
- Gary Thompson, Sun Microsystems
- NCIIA grant 2006-2008
- IBM grant 2009-2010
- Campus Second Life grant
- Seidenberg School of CSIS