Seeds of Evidence: Integrating Evidence-Based Software Engineering
(or “What I did in my first grad course last fall”)

David Janzen
*Cal Poly, San Luis Obispo*

Jungwoo Ryoo
*The Pennsylvania State University, Altoona*
SE Goals (among others)

• Industry’s Goal:
  – Apply the most efficient (fastest or least costly) method/tool to produce, maintain, and evolve software that satisfies requirements with the fewest defects and best maintainability/reusability

• Academia’s Goal:
  – Apply the most effective method/tool to convert novice freshmen into industry-ready professionals who can achieve Industry’s Goal

• Research’s Goal:
  – Discover/innovate methods and tools for meeting Industry’s and Academia’s Goals, and demonstrate their efficacy

In other words, Prove it!
EBSE

• Evidence-based/empirical software engineering uses tools like controlled experiments and case studies to answer questions like:
  – What is the “better” way to do software engineering in a given context?
    • PSP/TSP, Scrum, RUP, or XP
    • Solo programming + inspections or pair programming
    • J2EE, .NET, or Ruby on Rails
Challenge to SE Educators

• How to:
  – raise awareness of EBSE among students and industry practitioners
  – improve student skills in finding and critically reviewing EBSE studies
  – do above without adding a course to the curriculum

• My Opportunity:
  – CSC508 Software Engineering I
Context

- Cal Poly, San Luis Obispo
  - About 18,000 students
  - "Learn-by-doing" motto
  - Strong industry connections

- Quarter system
- CSC508 is first of two SE grad courses
- My first time to teach a grad course

<table>
<thead>
<tr>
<th>CS Dept.</th>
<th>CS</th>
<th>SE</th>
<th>CPE</th>
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<tbody>
<tr>
<td>Undergrad</td>
<td>510</td>
<td>50</td>
<td>450</td>
</tr>
<tr>
<td>Graduate/4+1</td>
<td>40</td>
<td></td>
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</tbody>
</table>
Course Goals

• Topics: Requirements Engineering, Project Management, Formal/Semi-formal methods

Project: Requirements with Prototype

Write a publishable paper

Develop EBSE awareness

Learn to find, read, and analyze scholarly SE papers

Engage “Net” generation
Approach

• Develop and populate a community-driven web database containing summaries of EBSE studies
  – SEEDS: SE Evidence Database System
• In teams of 4, students wrote requirements specifications and implemented horizontal and vertical prototypes of the system
• Individually students found and wrote summaries for 17 EBSE studies on a topic of their choosing
User Stories

All papers will now be known as publications. Topics will now be known as categories.

- Papers
  - US-1: Add a new paper to the site
  - US-2: Browse and view existing papers
  - US-3: Edit a previously submitted paper
  - US-4: Flag a paper for removal
  - US-18: Rate a paper

- Comparing Papers
  - US-14: Compare Papers Side-by-Side
  - US-15: Compare All Papers under Topic

- Summaries
  - US-5: Add new Summary
  - US-6: Edit Summary
  - US-7: View Summary
  - US-8: Rate Summary

- Users
  - US-9: Register User
  - US-10: User Login
  - US-11: Logout User
  - US-12: Edit User Information
  - US-13: Request Password

- Paper Topics
  - US-16: Add New/Edit Topic
  - US-17: Select Topic Parent

Priority
1. US-2

Highest rated summaries bubble to top; think urbandictionary.com or amazon.com
Accomplishing Goals Synergistically

- Project: Requirements with Prototype
- Develop EBSE awareness
- Engage “Net” generation
- Write a publishable paper
- Learn to find, read, and analyze scholarly SE papers
- SEEDS
  - Build
  - Produces
  - Engages
  - Enables
  - Populate
"PumaSEED"

View "Publication"

<table>
<thead>
<tr>
<th>Reviewer: JavaRockStar</th>
<th>Positive Summary Rating: 54/88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Rating: 9</td>
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<td>Significance Rating: 8</td>
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"PumaSEED"

Add "Publication" Summary

"Publication" Title: Using Test Driven Development to Stay on Schedule

Author(s): John Doe and Frank Smith

Add Summary:

Poor ----------------> Excellent

Overall Rating: ★★★★★★★☆☆☆☆

Quality Rating: ★★★★★★★☆☆☆☆
Add a Summary

Add a Summary

Topic

- Code Refactorization Methods
- Extreme Programming
- Metrics
- Paired Programming
- PSP
- SCRUM
- Static Analysis
- Test-First Procedures
- Waterfall Process

Reference

S. Edwards. Using Test Driven Development

Summary

|    |
Pair Programming

How To View the *Comparison Grid* for Pair Programming.

Pair Programming in an Introductory Computer Science Course: Initial Results and Recommendations
Williams, L., Yang, K., Wiebe, E., Ferzli, M., Miller, C., 11/2002 4.4 (12 users)

Prior research indicates that pair programming, whereby two programmers work collaboratively on the same design, algorithm, code, or test, produces higher quality code in essentially half the time...

Pair Programming in an Introductory Computer Science Course: Initial Results and Recommendations 2
Williams, L., Yang, K., Wiebe, E., Ferzli, M., Miller, C., 11/2002 4.3 (12 users)

Prior research indicates that pair programming, whereby two programmers work collaboratively on the same design, algorithm, code, or test, produces higher quality code in essentially half the time...

Pair Programming in an Introductory Computer Science Course: Initial Results and Recommendations 3
Williams, L., Yang, K., Wiebe, E., Ferzli, M., Miller, C., 11/2002 4.1 (12 users)

Prior research indicates that pair programming, whereby two programmers work collaboratively on the same design, algorithm, code, or test, produces higher quality code in essentially half the time...
<table>
<thead>
<tr>
<th>Title</th>
<th>Type of Experiment</th>
<th>Size</th>
<th>Class Level</th>
<th>Student Sub-Type</th>
<th>Selection Method</th>
<th>Data Collection Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>But, isn't that cheating?</strong></td>
<td>Case Study</td>
<td>20</td>
<td>Junior/Senior</td>
<td>N/A</td>
<td>Signed up for Pair Programming Course</td>
<td>Survey @ end of course</td>
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<td><strong>On the Impact of a Collaborative Pedagogy on African-American Millennial Students in Software Engineering</strong></td>
<td>Case Study</td>
<td>11</td>
<td>3rd &amp; 4th Year</td>
<td>African-American, born &gt; 1982</td>
<td>Theoretical Sampling</td>
<td>Semi-structured interviews</td>
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<tr>
<td><strong>Voices of women in a software engineering course: reflections on collaboration</strong></td>
<td>Case Study</td>
<td>3</td>
<td>3rd &amp; 4th Year</td>
<td>Female</td>
<td>?</td>
<td>Semi-structured interviews, 2 pg project retrospective.</td>
</tr>
</tbody>
</table>

**Edit the Table:**
- Delete
- Insert After

Select All Papers - Select No Papers - Select All Attributes - Select No Attributes

Papers not shown:
- Changing Students' Perceptions: An Analysis of the Supplementary Benefits of Collaborative Software Development
Showing Off

• Because of time constraints, students needed to populate SEEDS before their prototypes were complete
• What to do?
• Used Drupal (content management system)
• Contained most of the desired features
• Took me two hours
• Students were devastated
Welcome

Welcome to SEED: Software Engineering Evidence Database

Select a topic on the left to see summaries of evidence-based software engineering studies. You may become a registered user if you would like to add a new study and summary, or rate a study.

Note: This rapid prototype was created by David Janzen, Assistant Professor of Computer Science at Cal Poly, and President of Simex LLC, using the drupal content management system. Initial content was supplied by students in the CSC508 Software Engineering I course at Cal Poly in Fall 2007.
Scrum

Agile offshore techniques - a case study
Mon, 11/19/2007 - 08:30 — mpanian

Author: A. Danait
Conference: Agile Conference
Pages: 214 - 217
Date: July 2005

Your vote:
Not rated yet

Read more

How Douglas County, CO Cut A Project Timeline In Half
Mon, 11/19/2007 - 08:28 — mpanian

Author: C. Fredrick
Journal: Agile Journal
Date: March 2007

Your vote:
Not rated yet
How Douglas County, CO Cut A Project Timeline In Half

Mon, 11/19/2007 - 08:28 — mpanian

Author: C. Fredrick
Journal: Agile Journal
Date: March 2007

This experience report talks about a Colorado county IT department's experience using Scrum to lower project estimates on a program to track sex offender registration. The team needed to deliver a project in half the projected time of a waterfall implementation. The report talks about picking the right members for a team, making sure to select someone open to change when transitioning from an old method to a new one. The team also believes that being co-located made a huge difference in their productivity. One big part of their increased speed is a large reduction in complexity. Utilizing tools such as the Google Maps API and Hibernate saved the team a lot of coding time regardless of using waterfall or Scrum.

Two problems the team encountered while trying to use Scrum was organizational change and personnel change. Some people in the organization, such as Business Analysts, were scared their job roles were going to be replaced. Others were just not comfortable working in a less structured environment than they were used to.

Your vote:

No votes yet

Scrum
Assessment #1

• How did the student EBSE summaries compare to those in other repositories?
  – Survey sent to industry practitioners in four companies: Amgen, Google, Intuit, LSI
  – Ten respondents
  – Compared to Empirical Research Repository hosted by Durham University
    • Summaries produced by researchers with strict inclusion guidelines
Practitioners found student surveys more useful
Interesting Additional Results

- Of the ten industry respondents
  - 5 had access to ACM or IEEE digital library
  - 7 had never read an EBSE study report
  - 3 thought they understood how EBSE techniques were applied to SE
  - 7 were likely to find and read EBSE studies prior to adopting an SE practice, process, method, or tool
Assessment #2

• How did the student EBSE summaries compare to those in other repositories?
  – Survey given to students in the class
  – Again compared to Empirical Research Repository hosted by Durham University
    • Summaries produced by researchers with strict inclusion guidelines
    • Students had not seen this repository previously
Usefulness of EBSE Summaries: Student Opinions

Students found their own surveys more useful
What did students think of the experience?

**Value of Preparing Summaries**

- Very valuable: 40% (Responses)
- Valuable: 30% (Responses)
- Neither valuable nor not valuable: 20% (Responses)
- Not valuable: 10% (Responses)
- Very not valuable: 0% (Responses)

**Value of Developing SEEDS**

- Very valuable: 20% (Responses)
- Valuable: 30% (Responses)
- Neither valuable nor not valuable: 20% (Responses)
- Not valuable: 15% (Responses)
- Very not valuable: 5% (Responses)
Wrap Up

• Visit and contribute to: http://www.evidencebasedse.com
• Improve SEEDS
  Email: djanzen@calpoly.edu
• Questions?