Security Injections Workshop - August 2010

Anne Arundel Community College
Bowie State University
Community College of Baltimore County
Harford Community College
Towson University
Today's Goals

• Project Overview
• Security Injection Details
• How can you participate?
• Project Results
• Feedback
Agenda

• 1:00 Lunch/ Introductions
• 1:30 Project Overview
  Security Injection Details/Process
  Results
• 2:30 Discussion
  Questions-What works? What doesn't?
  How do we make these materials more effective?
  Encourage others to use them?
• 3:00 Schedule
  Wrap-up
Overview

Project Goals and Motivations

• Importance of Security
• Security Tracks and classes
  – Too little too late
  – Insecure coding techniques
• Security Injections
  – Early and often
  – Minimally invasive
Overview

Security Injection Modules

• Secure coding “big three”
  – Integer overflow
  – Buffer overflow
  – Input validation

• CISO (Computer Literacy)
  – Phishing
  – Passwords
  – Cryptography
Overview
Security Injection Modules

• Format of modules
  1. Background - description, risk, examples
  2. Lab Assignment
  3. Checklist
  4. Discussion Questions
     – Java/C++/Python/Pseudocode versions

• http://triton.towson.edu/~cssecinj/
Security Injection Details

- CS0, CS1, & CS2 (Blair)
- CIS0 (Computer Literacy) (Claude)
- Dbase (Shiva Azadegan)
- Web (Sidd)
- Networking (Claude)
- MAISA (Mike O’Leary)
Process - How can you participate?

http://triton.towson.edu/~cssecinj

1. Administer Security Survey
2. Introduce Security Injections in class
3. Administer Security Survey
4. Complete Faculty Survey
Status

Student participation

<table>
<thead>
<tr>
<th>Institutions</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sections</td>
<td>40+</td>
</tr>
<tr>
<td>Survey responses</td>
<td>1,630 (800+ students)</td>
</tr>
<tr>
<td>Courses</td>
<td>CS0, CS1, CS2, Comp. Lit.</td>
</tr>
</tbody>
</table>

Faculty

<table>
<thead>
<tr>
<th>Institutions</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>Workshop attendees</td>
<td>55+</td>
</tr>
<tr>
<td>Participating faculty</td>
<td>38 (integrated and control)</td>
</tr>
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Status (cont.)

• **Outreach**
  
  – 2009, CISSE, Seattle
    • *Cross-site Security Integration: Preliminary Experiences across Curricula and Institutions*
    • *Cooperative Information Assurance Capacity Building*
  
  – 2010, SIGCSE, Milwaukee
    • Birds of Feather with UNCC, Syracuse, Northern Kentucky, East Washington
    • NSF showcase
  
  – 2010, CISSE, Baltimore
    • Injecting Security in the Curriculum - Experiences in Effective Dissemination and Assessment Design
**Survey - 1,630 Responses - Summary**

- **Student Gender**
  - Male 62.7%
  - Female 29.7%

- **Student Ethnicity**
  - White 59.3%
  - Under-represented Minorities 35.2%
  - Other 5.5%

- **Student Standing**
  - Freshman 31.2%
  - Sophomore 31.7%
  - Junior 27.9%
  - Senior 9.2%

- **Student Major**
  - CS/IS/IT 46%
  - Math 4.51%
  - Undecided 7.7%
  - Other 27.7%
Assessment Design and Results

• Four primary goals to assess
  1. increasing students’ security awareness
  2. improving students’ ability to apply security principles
  3. increasing faculty security awareness
  4. increasing the number of security-skilled students

• Instruments
  – student and faculty surveys
  – random sampling of assignments
  – qualitative inputs from faculty
  – controlled experiments in classrooms
  – institutional quantitative data
Increase in Student Awareness – Assessment Design

• Two strategies need to be evaluated
  – Test security awareness at the end of foundational courses
  – Test security awareness due to repeated exposure

• Each class that used the module is referred to as a ‘integrated’ section

• All classes were administered a pre-survey and a post-survey
  – Each survey has
    • demographic information
    • general security awareness questions, and
    • questions targeted at the injections (secure coding for CS0,1,2)
1,026 survey responses, 40+ sections, 5 institutions

- Significant increase ($p<0.01$) in across core courses, CS0, and CS1
  - but not in CS2 (topic fatigue in CS2?)

These results persisted across majors
Results – Student Awareness

- 300 survey responses, 4 institutions
- Significant increase in scores from pre to post in integrated sections

**Computer Literacy Survey Results**

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<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
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<tbody>
<tr>
<td></td>
<td>8.5</td>
<td>10.5</td>
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<td></td>
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<td></td>
<td>10.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td></td>
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</tbody>
</table>

17.37% Significant
Increase in Student Ability to Apply - Split Sections

• Another quasi-experimental strategy was to have one integrated section and one control section under the same instructor.

• Pre-surveys and post-surveys were administered in both the sections.

• In addition, a more stringent ‘code-check’ was given at the end.
Results – Split Section

- Both sections had higher scores in the post-survey
  - even though there was no significant difference in the pre-survey scores of the two sections - so they started at the same place.
  - There was a 40.61% increase in the scores on the integrated sections – this was significantly higher than the control section.
Results
Faculty Surveys

• 13 faculty for spring 09 and fall 09
1. How would you rate the student interest in the security materials?
   Not very interested 1  2  3  4  5  Extremely interested
   ➢ Most answered between 3 and 4
2. How well were you able to incorporate these materials in your class?
   Very troublesome 1  2  3  4  5  No problems at all
   ➢ Most answered between 4 and 5
3. Did time spent on these topics take detract from other topics that you might have covered?
   Not at all 1  2  3  4  5  Significantly
   ➢ 10/13 answered 1
4. Did the materials help you with your level of confidence in teaching the security concepts?
   • Not at all helpful 1  2  3  4  5  Very helpful
   ➢ All felt the materials helped their level of confidence
5. Would you recommend these materials or this approach to a colleague?
   Definitely not 1  2  3  4  5  Absolutely
   ➢ 10/13 answered 5
How can we improve?

• More students + more institutions
• Getting faculty involved
• Feedback on modules
• More split sections
Summary

• [http://triton.towson.edu/~cssecinj/](http://triton.towson.edu/~cssecinj/)
• materials for CS0, CS1, CS2
• CIS0 - computer literacy
• Database, Web starting
• Identify courses, sections
Questions

• Feedback
  – Changes to modules
  – Usage of modules
• Timing of modules
• Participation
  – How can we get colleagues to adopt?
  – What project/institutional support is needed?
  – Any issues specific to your context that we should know about?
• Brainstorm
  – Your needs?
  – Other modules?