One-Minute Feedback

[Activity]

- What ideas / questions did reading __________________ prompt in you?

How This Activity Relates to the Topic / Thesis?

- Seeking feedback
- Instructor listens, audience participates
- Rapid, efficient feedback
- Willingness to adapt and follow the energy of the audience
- Pursue relevance to audience
- Non-threatening (anonymous)
- Unpredictable responses, instructor cedes some control in exchange for relevance

Effective Feedback Approaches to Support Engineering Instruction and Training in Project Settings

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My Goals

Involve
Inform
Inspire

Outline of the Talk

- Conceptual framework
  - Problem statement and main contributions
  - What makes feedback effective?
  - Agile teaching: principles and practices
  - Technological approaches to feedback
  - Implementation of the ideas in a real setting
  - Analyzing and using feedback data to inform refinements
- Synthesis

Conceptual Framework

- “Axioms”: active learning, experiential learning, collaborative learning, cooperative learning
- Learning formula:
  \[
  \text{Learning} = (\text{Practice} + \text{Feedback} + \text{Reflection})^+ 
  \]
- Synergy between the three components
  - There’s a positive feedback loop between them, not a fixed contribution of each
  - More/less of one element means more/less of the others too
High-Level Questions
- What does it mean for feedback to be effective?
- How can feedback be utilized to improve the processes of teaching, learning, and communication?
- How can feedback in turn be supported and enhanced (by technological and non-technological means)?

Main Contributions
- Defining a new teaching methodology inspired by the principles of agile software development
- Proposing and analyzing technologically-supported techniques for promoting student engagement, interaction, and feedback in the classroom
- Designing and deploying tools to enable scenarios for which feedback channels have previously been closed:
  - Structured peer feedback
  - Survey data collection and aggregation
- Analyzing an extensive set of multi-year feedback data to inform gradual improvements in both content and processes in a course

What Makes Feedback Effective?
- Important to know for evaluating a newly proposed technique or tool (relative to alternatives)
- Most techniques have strengths and weaknesses
  - Knowing the tradeoffs helps
- For a balanced set of techniques / tools, evaluate feedback coverage of important areas of learning
  - Individual feedback, team feedback, project feedback

Some of the \textit{Less Obvious} Qualities of Effective Feedback
\begin{tabular}{l|l}
\textbf{Desired:} & \textbf{Reality:} \\
\hline
- Allowed, welcome & - The proposed techniques and tools exhibit all of the above. \\
- Situated & - Most classes and projects limit themselves to techniques that are efficient, but rarely offer any of the other qualities. \\
- Efficient, sustainable & \\
- Open, inclusive & \\
- Representative & \\
- Palatable & \\
- Just-in-time & \\
- Iterative & \\
\end{tabular}

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Agile Teaching Methodology
- Main \textit{agile teaching} principles
  - Focusing on most relevant aspects for students
  - Seeking student feedback
  - Follow the energy of the students, adjusting to their needs and level of understanding
  - Short feedback iterations
- Parallel \textit{agile software development} principles
  - Focusing on highest value areas to customers
  - Seeking customer feedback
  - Adapting to changing needs and context
  - Rapid iterations
Agile Teaching Practices
- Frequent project milestone deliveries
- Post-milestone informal project discussion meetings
- Post-milestone in-class retrospectives

Mechanisms for Just-in-Time Feedback
- Minute paper
- Mid-term and end-of-term student surveys
- Reflective writings
- Anonymous feedback
- Classroom interaction systems

Impact of Agile Teaching on Instructors
- Demands on time
  - Reorganization of time allocation based on what brings most value to students
- Satisfaction
  - Stimulating; high relevance of instructor effort
- Need for flexibility
  - Works for some, may not work for others
- A different mindset
  - Goal-oriented, not content-oriented

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Technological Approaches to Supporting Feedback

**Goal:** offload routine activities, allowing users to do creative work

**Example systems:**
- Classroom interaction systems (e.g., Classroom Presenter)
  - Engage students in class
  - Facilitate feedback to and from students
- Other feedback-promoting tools
  - Anonymous peer feedback tool
  - End-of-term student survey tool

August 27, 2007 PhD Thesis Talk

Classroom Presenter

**Goals:** promote student engagement, interaction in classrooms, and bi-directional feedback

Pedagogical Techniques Supported by Classroom Presenter

- Atmosphere for Engagement [SwEng, Algo, ESRM]
- Problem Exploration [SwEng, Algo, ESRM]
- Discovery, Making a Pedagogical Point [Algo]
- Collective Brainstorming, Expression of Diverse Points [SwEng, ESRM]
- Student Feedback to Instructor [SwEng, Algo, ESRM]
- Eliciting Misconceptions, Feedback on Student Ideas [SwEng, Algo, ESRM]
- Active and Collaborative Learning [SwEng, Algo, ESRM]

**Overall:** All support feedback: student-to-self, student-to-peers, student-to-instructor, or instructor-to-student

Supporting Pedagogical Goals: Discovery, Eliciting Misconceptions

- Deception can be present
- Ah-ha moments
  "I have never understood this before – but it is obvious"
- Important to have all students work on the example

Supporting Pedagogical Goals: Feedback to Instructor on Student Understanding

Supporting Pedagogical Goals: Brainstorming, Diversity of Opinions

**Your Options If You Fall Behind Schedule**

**What type of tasks might have the following DFs?**

**How People Learn**

- What do you think?
- People learn best when... they are interested and engaged.

- How do you learn best when...?
  - How do you learn the three graphs?
Supporting Pedagogical Goals: Hearing Student Ideas, Closure

One-Minute Feedback
- What one or two ideas discussed today captured your attention and triggered the most
  memorable learning moment?
- What do you think about your group's (or class's) ideas?
- What questions still remain open for you? Be specific.
- What did you learn?

Other Feedback-Promoting Tools
- Enable feedback where previously there was none; addresses the opportunity cost
- Make it low-cost and high-payoff, so that potential adopters would not be discouraged
- Paper-based equivalents don’t scale well

Examples:
- Iterative, structured student-to-student feedback
- Extensive end-of-term feedback from students to instructors on the course

Design Principles:
- Aim for simple working prototypes
- Allow pseudo-anonymity of students

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Empirical Validation
- Principles and practices have been successfully employed in a course
- Enabled steady incremental evolution
- Selectively employed by different instructors in several courses
- Positive and improving end-of-term student feedback
- Consistently and correctly highlighted strengths and revealed weaknesses

Other Feedback-Promoting Tools: Structured Peer Feedback

Legend: The highest rating is 5 (very positive evaluation), and the lowest is 1. Use the rating N/A when you have no relevant observations on that person. You may choose to rate yourself, or just leave the default N/A value.

<table>
<thead>
<tr>
<th>Name</th>
<th>Team</th>
<th>Rating</th>
<th>Strengths to Sustain</th>
<th>Areas to Improve in</th>
</tr>
</thead>
<tbody>
<tr>
<td>John A</td>
<td>A</td>
<td>5</td>
<td>Team leadership and communication with the customer</td>
<td>Bring it on time at regular team meetings</td>
</tr>
<tr>
<td>Danny B</td>
<td>A</td>
<td>3</td>
<td>Consistently seek new ways to improve the team’s product</td>
<td>Ask teammates if you agree with your instructions</td>
</tr>
<tr>
<td>Maria C</td>
<td>B</td>
<td>4</td>
<td>Willingness to help teammates in all aspects</td>
<td>Not being afraid to speak up at meetings</td>
</tr>
</tbody>
</table>

Other Feedback-Promoting Tools: End-of-Term Student Survey
Application of the Ideas to a Software Engineering Course

Course goals: students learn how to work effectively in larger teams and deliver value on longer-term projects

Organizing course principles:
- Giving students an opportunity to correct early missteps
- Blending "soft" (people-related) topics into the curriculum
- Keeping open the bi-directional feedback channels b/w students and instructor
- Enabling prompt adjustments
- Having students own their decisions
- Keeping students’ motivation high and maintaining their vested interest
- Establishing a baseline for evaluating changes between course offerings

Feedback Techniques in Action: In-Class Project Retrospectives

Feedback Techniques in Action: Instructor Course Retrospectives

Feedback Techniques in Action: Other
- Informal project discussion meetings
- Reflective writings, leading to virtual (feedback) conversations
- Anonymous peer feedback

Note: All are bi-directional – used for giving and receiving feedback

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Feedback-Revision Cycle
- Regular, iterative feedback gathering and analysis
- Conscientious, disciplined, much more extensive than standard student feedback instruments
- Sources of feedback:
  - Students through detailed end-of-term survey
  - Instructors through end-of-term course retrospectives
- Produces feedback data to inform gradual evolution of course
End-of-Term Student Surveys

Format:
- Required, quasi-anonymous, questions could be skipped, timed for about 30 minutes
- Detailed questions on important course-related aspects
- Both multiple-choice and free-form short questions

Strategies:
- Questions: what worked well, what did not work well, what changes may help
- Goals: evaluate risks, reveal surprises, and compare with previous measurements
- Evolution based on predictability of the responses, need to elaborate on specific areas, need to cover new themes/aspects featured in the latest offerings

Instructor Course Retrospectives

Format:
- 1-2-hour discussion on average, students do not participate
- Based on all materials in the course, including students' feedback and informal interactions

Strategies:
- Questions: what should be sustained? what needs to be improved?
- Goals: create a lasting record of what instructors learned: a balanced, “big picture” view of course; formulate intention for change; transfer distilled lessons easily to other instructors

What the Student Feedback Data Told Us: Overall Metrics

- 88% felt better prepared for industry careers after taking the course
- 38% had significantly changed their understanding of the essence of software engineering during the course
- Most common one-word descriptions of the essence of the course: “experience,” “teamwork,” “people,” “learning,” “process,” “valuable/useful,” “communication,” “frustration”

What the Student Feedback Data Told Us: Comparison b/w Terms

Student perceptions of various team sizes

Class-average rating for a given team size

Term 1 2 3 4 5 6 7

What the Student Feedback Data Told Us: Comparison b/w Terms (2)

Student perceptions of reflective writings

Class-average rating for reflective writings

Term 1 2 3 4 5 6 7

What the Student Feedback Data Told Us: Comparison b/w Terms (3)

Student perceptions of the reading materials

Class-average ratings

Term 1 2 3 4 5 6 7

Main text Additional text Handouts
Surprises Found in the Student Feedback Data
- 96% of students reported no transfer ("borrowing") of ideas from peers
- Majority of students did not want to watch videos of themselves presenting
- Among the hardest exam questions were those from the textbook

Conclusions: Synthesis
In my thesis work, I have:
- Proposed new feedback tools and techniques that are low-cost and high-payoff
- Demonstrated that they are feasible and have a positive effect in a real course over multiple terms
- Worked with others to transfer successes to their classrooms too

Conclusions: Main Contributions
- Defining a new teaching methodology inspired by the principles of agile software development
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Discussion
Questions?