Learning Software Engineering - Online

29th Pacific NW Software Quality Conference
Oct 10-12 2011
Kal Toth, kalmanctoth@gmail.com

Unstated Goal

Learning Systems

common methods, processes & tools

Social Networks
Work Groups
Perspectives Addressed

Online/hybrid delivery of SE Courses and Programs
- UBC, Simon Fraser, TechBC, OSU, PSU

Evolution of e-learning delivery
- Emergence, systems, tools
- Broadcasting sessions / lectures
- Learning management systems
- Asynchronous and synchronous collaboration
- Social, professional, and work networks

E-Learning Challenges and Success Factors

Advanced Software Engineering Education

<table>
<thead>
<tr>
<th>Professional Development</th>
<th>Graduate Certificates</th>
<th>Masters Degrees</th>
</tr>
</thead>
</table>

Software and IT professionals and practitioners

Primary Objectives:
- Enhance professional software competencies
- Develop job-ready technical team leaders and managers
- Flexible delivery and access
Curriculum and Careers

SE Courses / Topics
- principles/processes
- project management
- agile development
- team collaboration
- quality engineering
- reqts & analysis
- architecture
- design techniques
- testing & impl’t’n
- estimating
- decision-making
- strategic issues
- process improv’t

Learning Elements, Methods, Mechanisms

<table>
<thead>
<tr>
<th>SE Curriculum:</th>
<th>Elements:</th>
<th>Learning Methods:</th>
<th>Online Mechanisms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>processes</td>
<td>Read</td>
<td>Presentations</td>
<td>• Broadcast Content</td>
</tr>
<tr>
<td>project mgt</td>
<td>Listen</td>
<td>Examples</td>
<td>• On-Demand A/V</td>
</tr>
<tr>
<td>agile dev</td>
<td>Think Critically</td>
<td>Case Studies</td>
<td>• Narrated PPTs</td>
</tr>
<tr>
<td>team collab</td>
<td>Analysis</td>
<td>Problems</td>
<td>• Repositories</td>
</tr>
<tr>
<td>quality eng’g</td>
<td>Solve</td>
<td>Questions</td>
<td>• Online Feedback</td>
</tr>
<tr>
<td>reqts &amp; analysis</td>
<td>Problems</td>
<td>Responses</td>
<td>• Discussion Forums</td>
</tr>
<tr>
<td>archit / design</td>
<td></td>
<td>Individual Assigns</td>
<td>• Web Conferencing</td>
</tr>
<tr>
<td>testing &amp; impl’t’n</td>
<td></td>
<td>Group Assigns</td>
<td>• New Media</td>
</tr>
<tr>
<td>estimating</td>
<td></td>
<td>Feedback</td>
<td></td>
</tr>
<tr>
<td>decision-making</td>
<td></td>
<td>Evaluation</td>
<td></td>
</tr>
<tr>
<td>strategic issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>process improv’t</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Career Progression Possibilities

- Project / Group Manager
- Team Leader / Manager
- SW Analyst
- SW Architect
- Product Manager
- SW Quality Engineer
- SW Developer
Evolution of E-Learning

Open University (UK), U of Athabasca, ...

Broadcast Lectures:
- Satellite distribution with feedback via text channels (NTU)
- Classroom recorded and distributed (tape, disk, streamed)

Work Group Teleconferencing [synchronous learning]:
- Telephone-Based Conferencing Technologies
- Functions, Features, Performance, Costly, Constrained Access

Asynchronous Learning Networks [Sloan Foundation, Drexler, …]
- Greatly facilitated by the emergence of the Web and common usage
- Benefits: anytime, anyplace, reflection, language, personality issues
- Counter-Arguments: Isolation, engagement, authentication

Learning Management Systems: E-College, WebCT, Bb, D2L, …
- Access to materials, collaboration, assignment handling, grading support, ...

Web conferencing; Social Networking / Media; Workgroup Tools

E-Learning Versus Traditional

Experts: no significant differences in learning outcomes
- Different e-learning methods probably fit different subjects
  (but not well understood)

Distinctions Blurring: Online Learning, Social & Work Networks
- How we learn, increasingly like how we work
- When we work, we are constantly learning
- Collaboration at work and at school are social experiences

We should harmonize our social, learning, and work processes!
Earliest Delivery Models
(some blending on face-to-face & asynch learning)

Asynch Learning (LMS):
- WebCT at UBC (1995)
- Virtual-U at Simon Fraser (1996-98)
- Custom LMS at TechBC (1999-2000)

OMSE:
- Recorded Lectures
- Some web-based content
- LMS: E-College (LMS) experiment (2003)

Broadcasting Lectures

SFU:1990s, PSU: 2003 ...

Remote control cameras and push-to-talk mics
PC, projector, doc camera controlled by instructor
Support personnel:
- Remote control cameras
- Audio-video captured, digitized, streamed via media server
- “Live Streams” (delayed 5-10 secs)
- Archived streams on-demand
Issues:
- Teleconferencing return channels not integrated
Learning Management Systems

Useful Capabilities:
- Managed access to course info and resources
- Assignment management, grading support, usage tracking
- Online (asynchronous) discussion forums
- Integration with registration and grading
- Guidance, pacing, announcements, EM, student lists

UIs have been somewhat clunky but getting better.

Mini-Lecture Approaches

Attempts to overcome student-faculty isolation:
- Pre-recorded studio lectures (canned)
  - more costly to produce; harder and more costly to update
- Narrated PowerPoint lectures
  - Cheaper and easier update

More study / assessment needed:
- Learning and engagement effectiveness
Online Learning Issues

Learning effectiveness of online methods
Faculty workload and ownership of their instructional materials
Student isolation – from faculty and other students
LMS Pros/Cons: good, bad and annoying features & performance
Overlooked Costs: conversion, training, learning (fac+stud)
Integration: LMS with registration and grading not seamless

Emerging Issues:
- How to integrate online systems with web conferencing, chat, twitter, and social networking capabilities

Student Preferences

Student Preferences Vary:
1. Opposed to online learning – only face-to-face acceptable
2. Prefer face-to-face over online
3. See value in blending online with face-to-face
4. Prefer online over face-to-face
5. Are unable to attend face-to-face – online is only choice

Wants:
- Social media features (like those used at home)
- Groupware features (like those used for work)

Criticisms:
- Performance, Quality of UIs, “Clunkiness”, …
Online & Hybrid Delivery

- shorter lectures
- Q & A
- Engagement:
  - direction
  - Q&A
  - feedback
  - evaluation
- Online Learning Infrastructure
  - Course Materials
    - syllabus, weekly lesson plan
    - "lectures", readings
    - case studies, examples
    - assignments, grades
    - shared resources

Engagement:
- a/v streams
- discussion forums
- teleconferencing
- email

Teams:
- grades
- assignments

Critical Success Factors for E-Learning (1)
(challenges needing to be overcome)

Achieving Faculty Buy-In to Overcome Concerns:
- Workload: Course development
- Course delivery: scalability not as advertised
- Learning effectiveness: Traditional (F2F) vs. Online
- Intellectual Property Rights: Online Learning Materials
- Cheating / authentication of students (exams, assignments)

Satisfying Student Expectations:
- Comparative quality: professional & social networks
  - Materials, media, organization & consistency of content
  - Performance: responsiveness, download time
  - Ease of use: intuitive user interfaces

Excerpt from PNSQC 2011
PNSQC.ORG
Copies may not be made or distributed for commercial use
Critical Success Factors for E-Learning (2)

Technology / Infrastructure:
- Delivery: good, bad and annoying features
- Help desk, performance, technical support / fixes
- Integration with registration/grading

Administration and Finance:
- Conversion costs, training, learning - underestimated
- Scalability potential - overestimated
- Need for marketing - underestimated
- Scholarly value of online pedagogy – under-recognized

Hybridizing/Blending Trend

Blend traditional F2F classroom with online learning methods
- Students use the same learning management system for web-enabled, online-only, and hybrid courses
- Same assignments, grading, EM, pacing, …
- Hybrid courses increase focus on online activities
  - Online discussions, group web-conferences, online exercises
  - Face-to-face sessions shorter, sometimes even optional
    (Reduces demand for scarce classroom space)

Distinctions blurring here too: web enhanced, online & hybrid
Hybrid / Blended Approach (1)

All students use the same LMS / course shell
- assignments, grading, EM, pacing, etc.

Face-to-face sessions are short lectures or Q&A sessions
- streamed over the web: support “live” & delayed access

Increased use of online discussions off-set reduced class time
- Reduces demand for scarce classroom space

Attending face-to-face sessions is optional
- Some students experience “hybrid”: others online (only)
- Online students rely more on streams & mini-lectures
- Face-to-face participation not evaluated
- But participation in online discussions is evaluated

Hybrid / Blended Approach (2)

Enriched Classroom Streams Using “Echo 360”:
- Merges A/V, presentation, doc camera streams
- Improved integration of information streams
- Better student control when viewing streams
- Higher overall resolution/quality of the mixed info streams

Flexible Synchronous Collaboration Using “Elluminate”:
- Work group activities: web conferencing, shared space
- More effective engagement → Audio/Video + collaboration
- Lower cost → Elluminate human controllers, reduces costs
- Instructors → Learning curve, training, setup coordination
- Empowered students to directly use Elluminate for projects
Benefits of Online Hybrid Learning Approach

Better learning:
- Integrates benefits of e-learning with traditional learning
- Asynch increases depth and breadth of engagement
- Students learn from each other as well as instructor

Reduces demand on [expensive] classroom facilities

Students:
- Integrates well with lifestyle of busy working professionals
- Reduced commute, residency, parking, and other costs

Faculty:
- Telecommuting reduces travel and office space costs
- Increases size of available pool of faculty

Annex: Screen Shot Illustrations

Desire-to-Learn (D2L): Learning Management System

Echo 360: Lecture Capture and Streaming System

Elluminate: Teleconferencing and Information Sharing System (now called Blackboard Collaborate)
## Excerpt from PNSQC 2011

### Table of Contents

<table>
<thead>
<tr>
<th>Week 1: Introduction to Software Quality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Software Quality (annotated)</td>
<td></td>
</tr>
<tr>
<td>Introduction to Software Quality (PDF includes slides)</td>
<td></td>
</tr>
<tr>
<td>Improving, Characterizing The Software Process</td>
<td></td>
</tr>
<tr>
<td>Agile Software Development</td>
<td></td>
</tr>
<tr>
<td>Find a brief introduction to your home</td>
<td></td>
</tr>
<tr>
<td>Week 2: Software Quality Assurance, Organization, Engineering</td>
<td></td>
</tr>
<tr>
<td>Week 3: Software Testing Activities and Handling</td>
<td></td>
</tr>
<tr>
<td>Week 4: Software Testing Techniques</td>
<td></td>
</tr>
</tbody>
</table>

Excerpt from PNSQC 2011 | PNSQC.ORG
Copies may not be made or distributed for commercial use
Questions?