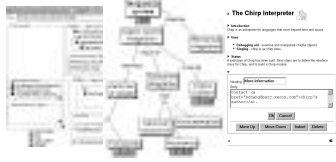


Gap Analysis of Educational Web Tools in Engineering and Technology



Dr. Kevin Oliver, Dr. John Moore, Virginia Tech
<http://www.edtech.vt.edu/dlnet/>

Abstract

A gap analysis of Web tools in Engineering was undertaken as one part of a larger grant entitled Digital Library Network for Engineering and Technology (DLNET), an NSF-sponsored collections grant in the national Digital Library program (DUE-00-85849). The DLNET project seeks to build a Web portal and an online review process to archive quality knowledge objects in Engineering. The gap analysis purposefully preceded the development of this portal to identify Web tools used or desired by faculty and students to help process information in the portal.

Processing the Information Explosion

- Web portals to educational content and modules make dissemination of information and ideas more efficient than ever before
- positive gains, but student experience is not necessarily changed unless the teaching strategy for processing that content is of high quality (e.g., problem-based approach), and/or students are given access to tools to help them process this ever-expanding information base

Tools are Available, BUT...

- Web course management systems like Blackboard and WebCT provide *some* tools for students to process online content
- key limitation, however, is that *most* of the tools are faculty-oriented toward disseminating information
- there is a need to design Web tools to aid student needs, not simply faculty content dissemination needs

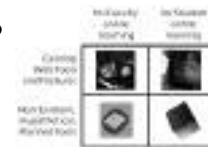


Technological Paradox (*Salomon*)

"... powerful and innovative technology is taken and is domesticated such that it does more or less what its predecessors have done, only it does it a bit faster and a bit nicer. Consequently, nothing really happens, which comes to prove what skeptics have argued all along and what misguided research tends to show: Technology makes no difference in learning. But of course it cannot make a difference since it has been domesticated to be totally subservient to the ongoing practices."

Gap Analysis Procedure, Round 1

- a panel of 66 Engineering and Technology faculty who use the Web to teach were identified with the assistance of grant partners IEEE and ASEE
- from 40 North American institutions
- first round of an online Delphi survey, faculty submitted recommended Web tools according to grid shown:



Gap Analysis Procedure, Sorting

- recommended tools sorted into thematic categories:
 - tools to create Web content
 - assessment tools
 - tools to disseminate or retrieve Web content
 - tools to collaborate or work with others
 - tools to process Web content
 - Web course management tools



Gap Analysis Procedure, Round 2

- 56 of 66 panelists, return rate of 85%, completed the second round of the analysis
- rating the 51 recommended tools on a Likert scale from “strongly agree” I need the tool to “strongly disagree” I need the tool
- 13 tools rated between “agree” and “strongly agree” that I need the tool
- 37 tools rated between “neutral” and “agree” that I need the tool
- only 1 tool rated below a neutral value

Gap Analysis Procedure, Group Comparisons

- one master list of rank-ordered tools created
- four discipline areas had enough panelists to create separate rank-ordered tool lists
- for statistical purposes, a fifth group consisting of “other” disciplines created
- two-way ANOVA for repeated measures
- no significant differences between group averages across the thematic tool categories (i.e., each tool category was rated evenly across the groups)

Gap Analysis Procedure, Group Comparisons

- significant differences in the ratings of thematic tool categories within a group ($p < .0001$) (i.e., a group would place different importance on the tool categories)



Rank Order of Tool Categories

	Average Category...	
	Rank Order	Likert Rating*
faculty tools to create Web content (CF)	10.6	4.138
assessment tools for faculty/students (AB)	18.7	3.911
faculty/student tools to disseminate/retrieve Web content (DB)	20.1	3.902
assessment tools for faculty (AF)	25.8	3.744
student tools to collaborate/work w/ others (WS)	28.5	3.712
course management tools for faculty/students (MB)	30.3	3.688
student tools to process Web content (PS)	31.2	3.650
faculty/student tools to collaborate/work (WB)	31.8	3.576
faculty tools to collaborate/work w/ others (WF)	37.5	3.573
student tools to create Web content (CS)	42.5	3.293

*Likert ratings... 5=strongly agree that I need the tool, 1=strongly disagree

Discussion

- the top-rated tool category (faculty tools to disseminate Web content), and the top four tool categories overall, are associated with a top-down, didactic approach to teaching
- three of the four lowest-rated tool categories are associated with a more democratic or constructivist approach to teaching (i.e., providing students with opportunities to collaborate and work with others or to create Web products)



Top-Ten Tools

- Faculty content development tool to create Web-ready documents containing predominantly text and images. Rank 1, Likert 4.661
- Faculty information dissemination tool to post homework assignments, lab assignments, problems, or exercises online, and my students to access, print, or download this information to complete outside of class time. Rank 2, Likert 4.375
- Faculty information dissemination tool to post course schedule, calendar, and/or syllabus online. Rank 3, Likert 4.370
- Faculty dissemination tool to post lecture notes, examples, whiteboard images from class sessions, or Powerpoint slides, online. Rank 4, Likert 4.304

Top-Ten Tools

- Faculty content development tool to create Web-ready documents with mathematical equations. Rank 4 (tie), Likert 4.304
- Faculty content development tool to create Web-readable, static or animated graphics, or 3-dimensional objects. Rank 6, Likert 4.214
- Faculty content development tool to scan print-based documents, and save these in Web-readable formats (e.g., HTML, PDF). Rank 7, Likert 4.164
- Faculty information dissemination tool to post my learning objectives for exams and quizzes, old print-based exams, and/or solutions to the questions online. Rank 8, Likert 4.143

Top-Ten Tools

- Faculty and student online communication tool to converse in an asynchronous format. Rank 9, Likert 4.130
- Faculty and student online gradebook. Rank 10, Likert 4.091



Discussion

- top eight tools focused on faculty creation or dissemination of Web content
- traditional, teacher-centered delivery of information
- not reflective of more contemporary learning models and tools that seek to actively involve learners in activities and interactions



Recommended Tools of Note

extensions to discussion boards, chats:

- Archival tools to save student questions for the purpose of generating a frequently asked questions (FAQ) database.
- Archival tools to clip or save portions of asynchronous communications (e.g., e-mails, discussion board transcripts) for the purpose of saving and sharing particularly good discussions with future students.
- Archival tools to record synchronous communications (i.e., live chat and live audio/video sessions) for students to replay and review whenever they miss a session or would like a review.

Recommended Tools of Note

extensions to course management systems:

- Instructor-to-instructor file exchange tool to share files with other instructors teaching similar courses. The tool could facilitate the development of a shared library, database, or archive of instructional modules.
- A pacing tool to scaffold or restrict student access to information on the instructor's Web site (e.g., students can't view chapter 3 until they've taken the chapter 2 quiz). Students will not be able to see certain portions of the Web site until a set rule has been met.

Recommended Tools of Note

extensions to course gradebooks:

- An online gradebook that interfaces with student tracking data, to correlate quiz/test performance w/ student access to online materials, tutorials, or exercises (i.e., Did students w/ low test scores access fewer online resources?).
- An online gradebook that allows students to access their individual scores in a secure location. The gradebook should be flexible to allow not only numeric scores, but also statements regarding lab performance, demonstration performance, and general comments about student progress.

Recommended Tools of Note

new tools to help students process content:

- Student-to-student file exchanging tools to share documents and to view others' reports and designs. Such tools might resemble a public drop box for the entire class or private drop boxes for project teams.
- Advanced editing and critiquing tools for course file exchange boxes to electronically mark-up documents (e.g., reports, Web pages). Sample features might include the ability to red-line text segments, attach electronic sticky notes, or use an electronic pen and pad to circle mistakes and hand-write comments in the margins.

Recommended Tools of Note

new tools to help students process content:

- Collecting tools to store online information students find during research (e.g., collecting facts, text, pictures, video clips, or links that are related to some concept or topic). Bookmarking tools and individual file space are types of collecting tools.
- example: Artemis (Univ. of Michigan)



Recommended Tools of Note

new tools to help students process content:

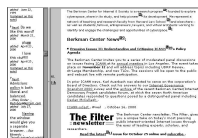
- Organizing tools to sort and arrange the online information that has been collected or exchanged (e.g., online concept mapping or diagramming tools that can be edited by a group over the Web).
- examples: CMap (West Florida), VisIT (Illinois) Sensemaker (Berkeley)



Recommended Tools of Note

new tools to help students process content:

- Integrating tools to merge student ideas and thoughts with online content (e.g., Web annotation software for students to post notes or questions directly on a Web site, or to mark-up or leave critiques on a Web site; ability to attach a sketch or graphic image to a portion of a Web site for the purpose of elaborating on the original document).
- examples: Harvard Annotation Engine, PageSeeder



Future Steps

we have integrated our tool lists with an annotation engine so site visitors may:

- post comments
- recommend specific software programs that match the tool descriptions
- describe how they apply certain tools in their classes, curricular ideas

further, we will recommend tools from the lists to help individuals process content deposited in the DLNET portal