Introduction to Evaluating, Selecting and Using Learning Technologies and Digital Learning Materials

Brandon Muramatsu
NEEDS/UC Berkeley

Joseph Tront
SUCCEED/NEEDS/Virginia Tech

Flora McMartin
MERLOT

Jean-Pierre Bayard
CSU Sacramento

Dr. Jean-Pierre R. Bayard
Professor of Electrical & Electronic Engineering
California State University, Sacramento
6000 J Street
Sacramento, CA 95819-6019
Tel: (916) 278-5847
Fax: (916) 278-7215
bayardj@csus.edu

Mr. Brandon Muramatsu
SMETE/NEEDS Project Director
University of California, Berkeley
3115 Etcheverry Hall
Berkeley, CA 94720-1750
Tel: (510) 643-1817
Fax: (510) 643-1822
mura@needs.org

Dr. Flora McMartin
MERLOT Director of Members Services And Evaluation
mcmartin@merlot.org

Dr. Joseph G. Tront
Professor of Electrical and Computer Engineering
Virginia Tech
359 Durham Hall
Blacksburg, VA 24061-0111
Tel: (540) 231-5067
Fax: (540) 231-3362
jgtront@vt.edu

Introduction to Evaluating, Selecting and Using Digital Learning Materials
Selected Resources

Framework for Selecting Learning Technologies
- Slides (Muramatsu, Tront, McMartin and Bayard)

Educational Digital Libraries
- Slides (Muramatsu, Tront, McMartin and Bayard)

Goals of Higher Education <not included, separate handout>
- Handout: Teaching Goals Inventory (Tom Angelo and Pat Cross)

Student Learning Outcomes
- Handout: NSF Gateway Coalition Student Learning Outcomes Inventory (Jack McGourty)

Good Teaching Practices
- Handout: Seven Principles for Good Practice in Undergraduate Education (Arthur Chickering and Zelda Gamson)

Evaluation and Selection Criteria and Guidelines
- Handout: Questions to Consider When Selecting Courseware of Software for your Courses

Peer Review Criteria
- Slides (Muramatsu, Tront, McMartin and Bayard)
- Handout: Selection Criteria for the Premier Award for Excellence in Engineering Education Courseware and Courseware Evaluation Form
- Handout: Evaluation Standards for Learning Materials in MERLOT

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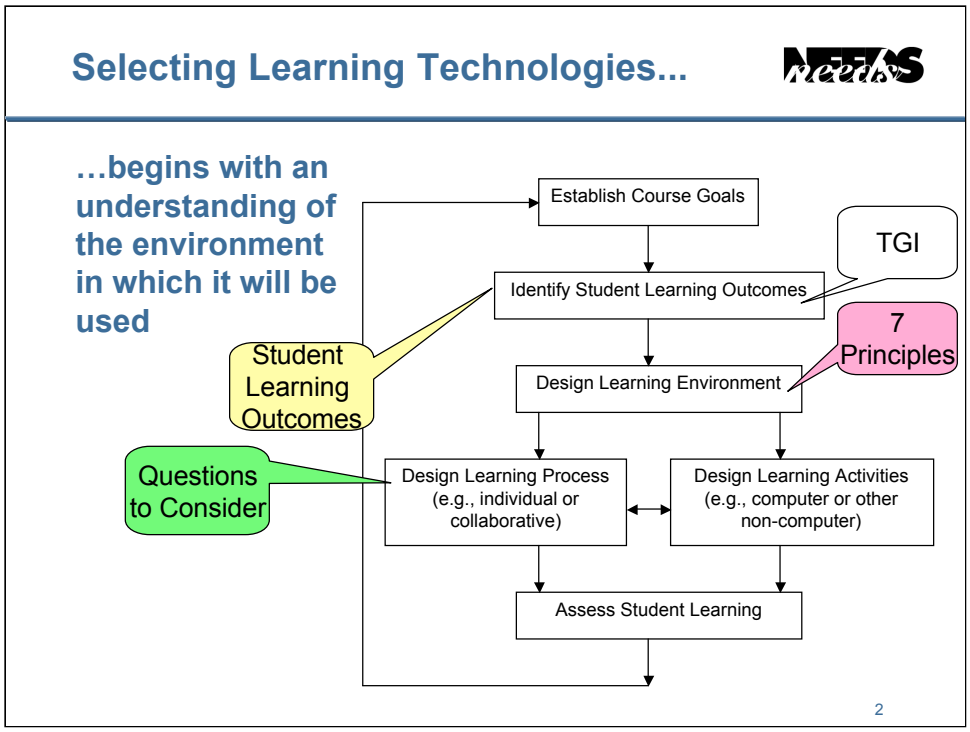


White Handout: Teaching Goals Inventory (Tom Angelo and Pat Cross)

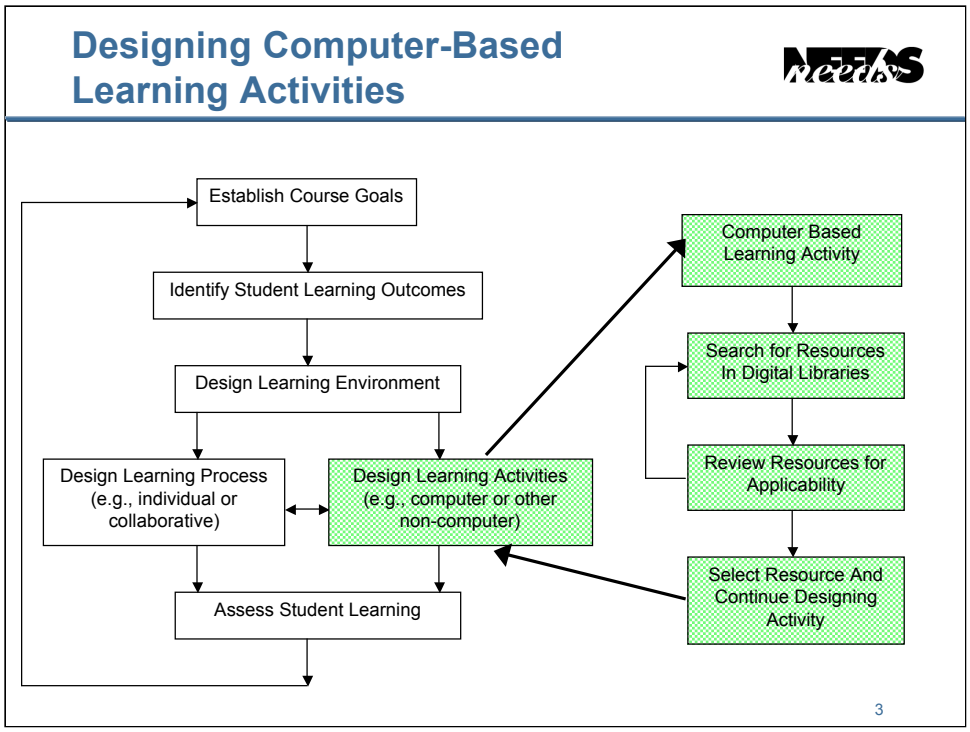
Yellow Handout: Gateway Coalition Student Learning Objectives

Pink Handout: Seven Principles for Good Practice in Undergraduate Education (Arthur Chickering and Zelda Gamson)

Green Handout: Questions to Consider When Selecting Courseware or Software for you Courses

Blue handout: Selection Criteria for the *Premier Award for Excellence in Engineering Education Courseware*

Evaluation Standards for Learning Materials in MERLOT



To select Resources for Computer-based Learning Activities, we suggest you use the following handouts:

- Questions to Consider When Selecting Courseware or Software for you Courses (Green Handout)
- Selection Criteria for the *Premier Award for Excellence in Engineering Education Courseware* (Blue Handout)
- Evaluation Standards for Learning Materials in MERLOT (Blue Handout)

You can find courseware and other computer-based resources at:

- SMETE Digital Library (www.smete.org)
- NEEDS Digital Library (www.needs.org)
- MERLOT (www.merlot.org)
- BioSci Ed Net (www.biosciednet.org)
- iLumina (www.ilumina-project.org)
- DLESE (www.dlese.org)

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Educational Digital Libraries

- **What do you think I mean?**
  - Who's the user?
  - What services are available?

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Campus Libraries and Research Digital Libraries

- **Traditional "brick and mortar" campus libraries**
  - Catalogs of resources
  - Repository of books, periodicals, etc.
- **Research digital libraries**
  - Typically provide convenient access to vast holdings, access to journals and databases

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"Working" Description of Educational Digital Libraries

…or…how they go beyond traditional brick and mortar library on your campus or research digital libraries…

- Directly supports teaching and learning activities
- Provides support (through comments of use, lesson plans, etc.) for adapting or adopting resources developed by others
- Uses technology to support collaboration, personalization, recommendation of resources
- Covers a wide range of disciplines and allows for connections between disciplines
- Supports communities of users

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SMETE Open Federation Vision

A Digital Learning Community

- **The SMETE Open Federation is an e-learning partnership that:**
  - Offers a comprehensive collection of STEM education content and services to learners educators and academic policy-makers
  - Serves as the integrative organization and distribution mechanism for pedagogical material through a tightly coupled federation of digital libraries
  - Promotes educational reform through participatory communities of learners

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The SMETE Open Federation…

- **Believes the NSDL should…**
  - Cover science, mathematics, engineering and technology
    - We emphasize the interdisciplinary and interconnectedness of learning materials
  - Focus on teaching and learning at the undergraduate and K-12 levels
    - We recognize the materials needed by faculty to support teaching and learning with these resources
  - Focus on the social aspects of building the NSDL as a community
    - We elevate community and social aspects to the same level as technical ones
  - Have tightly federated/integrated collections and services to allow users the best possible experience

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Reach of the Open Federation

- Identifiable audience of **9.25 million** users
- About **250,000** directly accessible community members
- Collectively has **42,000** high-quality, web-accessible digital learning resources
  - 28% Math
  - 17% Physical Sciences (physics, chemistry)
  - 19% Life Sciences
  - 4% Engineering
  - 3% Computer Science
  - 29% Non-STEM (History, World languages, etc.)
- K-12/Higher Education
  - Higher education resources 65%
  - K-12 education resources 35%

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SMETE Open Federation			Industry
Access Excellence & National Assoc. Biology Teachers (www.accessexcellence.org and www.nabt.org)	Digital Library for Earth Systems Education (www.dlese.org)	Mathematics Association of America (www.maa.org)	Autodesk* (www.autodesk.com)
American Association for the Advancement of Science (www.aaas.org)	Education Development Center (www.edc.org)	MathDL (www.mathdl.org)	Cisco Systems (www.cisco.com)
Association of Women in Science (www.awis.org)	Eisenhower National Clearinghouse (www.enc.org)	Math Forum (www.mathforum.com)	John Wiley & Sons* (www.wiley.com)
BioQUEST Curriculum Consortium (www.bioquest.org)	Gender and Science Digital Library (www.gsdl.org)	MERIT Network & Michigan Teacher Network (www.merit.edu)	Collegis (www.collegis.com)
Biosci Ed Net (www.benproject.org)	iLumina (www.ilumina-project.org)	MERLOT (www.merlot.org)	MathWorks* (www.mathworks.com)
Coalition for Networked Information (www.cni.org)	Instructional Architect (ia.usu.edu)	National Center for Supercomputer Applications (www.ncsa.org)	Microsoft Research* (research.microsoft.com)
CITIDEL (www.citidel.org)	Interactive University (iu.berkeley.edu)	NEEDS—A Digital Library for Engineering Education* (www.needs.org)	Sun Microsystems (www.sun.com)
ComPADRE/Physical Sciences Resource Center (www.psrc-online.org)	Internet Scout Project (scout.cs.wisc.edu)	Project Kaleidoscope (www.pkal.org)	*Support NEEDS
Computer Science Teaching Center (www.cstc.org)	Learning Matrix (thelearningmatrix.enc.org)	University of California Teaching and Learning with Technology Center (www.uctltc.org)	
	Learning*Online* Network with CAPA (www.lon-capa.org)		

Development Philosophy

- **The difference is *learning*, not just bibliographic information retrieval**
  - Teaching and learning require something more
- **Guided by *user needs* and philosophy of education that is constructivist**
- **Link content to community and services**
- **Build integrative tools and incorporate "best of breed" tools from partners**

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Strengths of Partners

- **Partners with existing collections each have a decade of experience providing digital SMETE resources to their target audiences and disciplines**
  - ENC, NEEDS, Math Forum, BioQUEST
- **Most partners each have more than ten years of experience as organizations promoting SMETE reform**
  - AAAS, Project Kaleidoscope, NACME, Mathematical Association of America, SRI International

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MERLOT

MERLOT
www.merlot.org

www.merlot.org

- **Collaborative to improve access to quantity and quality of teaching and learning resources and to help faculty identify and use those materials**
- **Institutional partnerships with 20+ systems of higher education in the U.S. and Canada**
  - Reaching 8 Million students
  - 350,000 faculty
- **Broad collection extending beyond STEM**
  - Search, browse, catalog, comments, assignments
  - Including: History, Music, World Lang., etc.
- **15 Disciplines doing peer review**
  - Including engineering in collaboration with NEEDS

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MERLOT

- **Building relationships with professional societies**
  - American Association of Physics Teachers
  - Journal of Chemical Education
  - …and through SMETE Open Federation
    - American Association for the Advancement of Science (and related societies through BEN Project)
    - Mathematical Association of America

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NEEDS—A Digital Library for Engineering Education

www.needs.org

- Established circa 1992 from NSF Synthesis Coalition (engineering education reform)
- Collection of digital learning resources for engineering education (search, browse, catalog)
- Served as technology platform for SMETE.ORG
- Recently re-launched to incorporate advances from SMETE.ORG

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NSF Gateway Coalition

Student Learning Outcomes Inventory

The purpose of this self-assessment inventory is to:

- ☑ Help you identify critical educational student learning outcomes for the course in question
- ☑.Support later decisions on the best assessment methods to apply in the classroom in order to measure whether these learning outcomes are being achieved by the students.

Please provide the following information for your records:

Your Name_____

Today's Date _____

Course or program you wish to focus on as you complete this inventory:

_____

When was the last time you taught this course?

_____

When is the next time you plan to teach this course?

_____

For more information on this survey please contact Jack McGourty, jm723@columbia.edu.

IMPORTANT!

Use these rating scale definitions as you work through the inventory. You will be rating the importance of each of listed student learning outcomes for the course or program you have selected to work on. Assess each outcome's importance as to what you want the learner to accomplish by the end of this course .

Rating Scale	Definition
5. CRITICAL Importance	One of the most important components of this course. Demonstrating this knowledge or skill is critical for the student to perform successfully.
4. CONSIDERABLE Importance	Among the more noteworthy parts of this course. Demonstrating this knowledge or skill well has a considerable impact on the overall performance of the student.
3. MODERATE Importance	A somewhat important component of this course. Demonstrating this knowledge or skill has a moderate impact on the student's overall performance.
2. MINOR Importance	Part of this course, but this knowledge or skill has only a minor impact on the student's overall performance.
1. NOT At All Important	Not a part of this course.

Student Learning Outcomes Instructor

Rate the importance of each student learning outcome as to what you want the student to accomplish in the course you have selected to focus on.

Analytical Skills *How important are the following student learning outcomes to the satisfactory completion of your course:*	Not at all important	Minor importance	Moderate importance	Considerable importance	Critical importance
Analyzes problems from different view points	1	2	3	4	5
Anticipates problems and develops contingency plans	1	2	3	4	5
Recognizes interrelationships among problems and issues	1	2	3	4	5
Applies logic in solving problems	1	2	3	4	5
Scales down information to what is important	1	2	3	4	5
Applies principles & generalizations already learned to new problems and situations	1	2	3	4	5
Communication Skills *How important are the following student learning outcomes to the satisfactory completion of your course:*					
Articulates ideas clearly and concisely	1	2	3	4	5
Uses facts to get points across to others	1	2	3	4	5
Plans and delivers oral presentations effectively	1	2	3	4	5
Organizes written materials in a logical sequence to enhance reader's comprehension	1	2	3	4	5
Applies presentation tools such as multimedia applications effectively when delivering a oral/written presentation	1	2	3	4	5
Uses graphics effectively to support the points being made	1	2	3	4	5
Demonstrates an ability to "think on one's feet"	1	2	3	4	5

Student Learning Outcomes Instructor

Creative Problem-Solving *How important are the following student learning objectives to the satisfactory completion of your course:*					
Challenges the way things are being done	1	2	3	4	5
Improves on what has been done before	1	2	3	4	5
Generates many potential solutions to a given problem	1	2	3	4	5
Suggests new approaches to solving problems	1	2	3	4	5
Discourages others from rushing to conclusions without facts	1	2	3	4	5
Handles unknowns or open-ended questions effectively	1	2	3	4	5
Demonstrates on openness to new ideas	1	2	3	4	5
Life Long Learning *How important are the following student learning outcomes to the satisfactory completion of your course:*					
Demonstrates ability to learn independently	1	2	3	4	5
Goes beyond requirements when completing assignments	1	2	3	4	5
Learns from mistakes and practices continuous improvement	1	2	3	4	5
Demonstrates a capacity to think for one's self	1	2	3	4	5
Assesses one's performance critically & accurately	1	2	3	4	5
Demonstrates responsibility for creating their own learning opportunities	1	2	3	4	5

Student Learning Outcomes — Instructor

Project Management Skills *How important are the following student learning outcomes to the satisfactory completion of your course:*	Not at all important	Minor importance	Moderate importance	Considerable importance	Critical importance
Sets goals to accomplish tasks on time	1	2	3	4	5
Clarifies task requirements and expectations as needed	1	2	3	4	5
Creates action plans and timetables to complete assigned work	1	2	3	4	5
Meets project milestones & deadlines	1	2	3	4	5
Prioritizes tasks to ensure meeting project milestones	1	2	3	4	5
Takes corrective action based on feedback from others	1	2	3	4	5
Research Skills *How important are the following student learning outcomes to the satisfactory completion of your course:*	Not at all important	Minor importance	Moderate importance	Considerable importance	Critical importance
Brings in information from "outside" sources to help make decisions	1	2	3	4	5
Uses computer-based and other resources effectively	1	2	3	4	5
Seeks information on problems from multiple sources	1	2	3	4	5
Understands importance of learning what has already been done to solve a given problem	1	2	3	4	5
Organizes information into meaningful categories	1	2	3	4	5

Student Learning Outcomes Instructor

Systems Thinking *How important are the following student learning outcomes to the satisfactory completion of your course:*	Not at all important	Minor importance	Moderate importance	Considerable importance	Critical importance
Demonstrates an understanding as to how events interrelate with each other	1	2	3	4	5
Integrates knowledge from diverse sources to solve technical problems	1	2	3	4	5
Takes new information and effectively integrates with previous knowledge	1	2	3	4	5
Uses knowledge from various courses in an integrated manner	1	2	3	4	5
Demonstrates an ability to synthesize and integrate information and ideas	1	2	3	4	5
Thinks holistically: sees the whole as well as the parts	1	2	3	4	5
Teamwork *How important are the following student learning objectives to the satisfactory completion of your course:*					
Helps reconcile differences of opinion among team members	1	2	3	4	5
Shares credit for success with others	1	2	3	4	5
Cooperates with others	1	2	3	4	5
Encourages participation among all team members	1	2	3	4	5
Shares information with others	1	2	3	4	5
Contributes his/her share of the project's workload	1	2	3	4	5
Demonstrates ability to take a leadership role in support of the team's goals	1	2	3	4	5

Student Learning Outcomes Instructor

Technical Competencies *How important are the following student learning outcomes to the satisfactory completion of your course:*	Not at all important	Minor importance	Moderate importance	Considerable importance	Critical importance
Demonstrates a basic knowledge of fundamental engineering principles in the specific disciplines focused on in this course/program	1	2	3	4	5
Integrates basic knowledge of other engineering disciplines within the scope of the course's project	1	2	3	4	5
Demonstrates a basic understanding of the design process from concept to prototyping	1	2	3	4	5
Demonstrates a basic knowledge of manufacturing processes	1	2	3	4	5
Incorporates principles of physical sciences and advanced mathematics into the solution of technical problems	1	2	3	4	5
Uses a basic knowledge of social sciences and humanities in the formulation of problem solutions	1	2	3	4	5
Demonstrates the ability to apply theoretical concepts to practical problem solving	1	2	3	4	5
Applies basic knowledge of management and economic theory to problem solving	1	2	3	4	5
Uses appropriate engineering tools and methods to solve problems	1	2	3	4	5
Uses computer tools and applications such as Pro Engineer and CADCAM effectively	1	2	3	4	5
Demonstrates an awareness of how what is learned in the classroom applies to industry	1	2	3	4	5
Demonstrates an ability to make informed ethical choices	1	2	3	4	5

1. How many student leaning outcomes to you rate as critically important (Rated 5)?_____
2. How many critically important student learning outcomes did you have for each broad student competency or skill?

Competency Category	# of Outcomes in Category	Total # of critically important learning outcomes (Rated 5)	Rank categories by number of critically important outcomes
Analytical Skills			
Communication Skills			
Creative Problem-Solving			
Life Long Learning			
Project Management			
Research Skills			
Systems Thinking			
Teamwork			
Technical Competence			

3. Compute your average ratings for each category using the following worksheet.

Competency Category	Sum ratings given to outcomes in category	Divide rating sum by this number	Category Average Ratings
Analytical Skills		**6**	
Communication Skills		**7**	
Creative Problem-Solving		**7**	
Life Long Learning		**6**	
Project Management		**6**	
Research Skills		**5**	
Systems Thinking		**6**	
Teamwork		**7**	
Technical Competence		**12**	

Seven Principles for Good Practice in Undergraduate Education

Adapted from BYU Faculty Center: www.byu.edu/fc/pages/tchlrnpages/7princip.html

Introduction

The "Seven Principles for Good Practice in Undergraduate Education" were created by Arthur W. Chickering and Zelda Gamson. These principles and the suggestions for implementation were distilled from decades of research on learning in higher education. The project received support from the American Association of Higher Education (AAHE), the Association of American Colleges (ACE), and the Johnson and Lilly Foundations. The investigators are leading scholars in faculty and student development who, amongst other things, solicited the ideas of hundreds of faculty members and administrators in North American colleges and universities.

Seven Principles was originally published in 1987; it is based on an underlying view of education as active, cooperative, and demanding (Chickering, p. 5). The goals of the authors are first, to identify practices, policies, and conditions that would result in a powerful and enduring undergraduate education, and second, to offer a set of research-based principles that would help sustain debate and action regarding undergraduate learning (Chickering, p. 13).

An enthusiastic response to the principles prompted the authors to develop a "checklist" for instructors (available from the BYU Faculty Center), with examples and indicators for each of the principles. The version included here of the seven principles that you are now reading was edited by Lynn Sorenson and Emily Burns at the BYU Faculty Center. It is a collection of teaching (and other) behaviors which have been shown to enhance student learning. Items selected for inclusion are applicable to a range of disciplines, institutions, and class settings. They are short and jargon-free, and they focus on behavior or practices that can be adopted.

Of course, no one instructor can perform all of the items listed here but it is the hope of the BYU Faculty Center that these principles will stimulate both discussion and action amongst faculty, students, and administrators. Student learning will be enhanced by the practice of these principles.

Summary of Seven Principles

Below are summaries of each of the 7 principles. Click on the specific principle to access the complete list of suggestions for implementation. Accompanying the suggestions are links to relevant articles from *Focus on Faculty*, the quarterly Faculty Center newsletter for those who teach at BYU. In addition, links are provided to pertinent *Questions and Answers for Teaching Assistants*, developed by D. Lynn Sorenson, Trav D. Johnson, Jessica Taylor and Shelley T. Graham for teaching assistants, student instructors, lab assistants, tutors, discussions leaders, graders and other roles of students charged with helping students learn.

1. Good practice encourages student-faculty contact

Frequent student-faculty contact in and out of class is the most important factor in student motivation and involvement. Faculty concern helps students get through rough times and keep on working. Knowing a few faculty members well enhances students' intellectual commitment and encourages them to think about their own values and future plans.

1. Advise students about career opportunities in their major/field of study.

2. Encourage students to drop by your office just to visit.
3. Share past experiences, attitudes, and values with students.
4. Attend events sponsored by student groups.
5. Work with student affairs staff on issues related to student extracurricular life and life outside of school.
6. Know your students by name within the first two weeks of the term.
7. Make special efforts to be available to students of a culture or race different from your own.
8. Serve as a mentor or informal advisor to students.
9. Take students to professional meetings or other events in your field.
10. Whenever there is a conflict on campus involving students, try to help its resolution.

2. Good practice encourages cooperation among students

Learning is enhanced when it is more like a team effort than a solo race. Good learning, like good work, is collaborative and social, not competitive and isolated. Working with others often increases involvement in learning. Sharing one's own ideas and responding to others' reactions improves thinking and deepens understanding.

1. Ask students to tell each other about their interests and backgrounds.
2. Encourage students to prepare together for classes or exams.
3. Encourage students to do projects together.
4. Ask your students to evaluate each other's work.
5. Ask students to explain difficult ideas to each other.
6. Encourage students to praise each other for their accomplishments.
7. Ask students to discuss key concepts with other students whose backgrounds and viewpoints are different from their own.
8. Create "learning communities," study groups, or project teams within your courses.
9. Encourage students to join at least one campus organization.
10. Distribute performance criteria to students so that each person's grade is independent of those achieved by others.

3. Good practice encourages active learning

Learning is not a spectator sport. Students do not learn much just sitting in classes listening to teachers, memorizing pre-packaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives. They must make what they learn part of themselves.

1. Ask students to present their work to the class.
2. Ask students to summarize similarities and differences among different theorists, research findings, or artistic works.
3. Ask students to relate outside events or activities to the subjects in the course.
4. Ask students to undertake research or independent study.
5. Encourage students to challenge your ideas, the ideas of other students, or those presented in readings or other course materials.
6. Give students concrete, real-life situations to analyze.
7. Use simulations, role-playing, or labs in your classes.
8. Create "learning communities," study groups, or project teams within your courses.
9. Encourage your students to suggest new readings, research projects, field trips, or other course activities.
10. Carry out research projects with your students.

4. Good practice gives prompt feedback

Knowing what you know and don't know focuses learning. Students need appropriate feedback on performance to benefit from courses. In getting started, students need help in assessing existing knowledge and competence. In class, students need frequent opportunities to perform and receive suggestions for improvement. At various points during college, and at the end, students need chances to reflect on what they have learned, what they still need to know, and how to assess themselves.

1. Give quizzes and homework assignments.
2. Prepare classroom exercises and problems which give students immediate feedback on how well they do.
3. Return examinations and paper within a week.
4. Give students detailed evaluations of their work early in the term.
5. Ask students to schedule conferences with you to discuss their progress.
6. Give students written comments on their strengths and weaknesses on exams and papers.
7. Give students a pre-test at the beginning of each course.
8. Ask students to keep logs or records of their progress.
9. Be available to discuss the results of the final examination with your students at the end of the semester.
10. Call or write a note to students who miss classes.

5. Good practice emphasizes time on task

Time plus energy equals learning. There is no substitute for time on task. Learning to use one's time well is critical for students and professionals alike. Students need help in learning effective time management. Allocating realistic amounts of time means effective learning for students and effective teaching for faculty. How an institution defines time expectations for students, faculty, administrators, and other professional staff can establish the basis for high performance for all.

1. Expect your students to complete their assignments promptly.
2. Clearly communicate to your students the minimum amount of time they should spend preparing for classes.
3. Make clear to your students the amount of time that is required to understand complex material.
4. Help students set challenging goals for their own learning.
5. When oral reports or class presentations are called for encourage students to rehearse in advance.
6. Underscore the importance of regular work, steady application, sound self-pacing, and scheduling.
7. Explain to your students the consequences of non-attendance.
8. Make it clear that full-time study is a full-time job that requires forty or more hours a week.
9. Meet the students who fall behind to discuss their study habits, schedules, and other commitments.
10. If students miss your classes, require them to make up lost work.

6. Good practice communicates high expectations

Expect more and you will get it. High expectations are important for everyone--for the poorly prepared, for those unwilling to exert themselves, and for the bright and well motivated. Expecting students to perform well becomes a self-fulfilling prophecy when teachers and institutions hold high expectations for themselves and make extra efforts.

1. Tell students that you expect them to work hard in your classes.
2. Emphasize the importance of holding high standards for academic achievement.
3. Make clear your expectations orally and in writing at the beginning of each course.
4. Help students set challenging goals for their own learning.
5. Explain to students what will happen if they do not complete their work on time.
6. Suggest extra reading or writing tasks.
7. Encourage students to write a lot.
8. Publicly call attention to excellent performance by your students.
9. Revise your courses.
10. Periodically discuss how well the class is doing during the course of the semester.

7. Good practice respects diverse talents and ways of learning

There are many roads to learning. People bring different talents and styles of learning to college. Brilliant students in the seminar room may be all thumbs in the lab or art studio. Students rich in hands-on experience may not do so well with theory. Students need the opportunity to show their talents and learn in ways that work for them. Then they can be pushed to learning in new ways that do not come easily.

1. Encourage students to speak up when they don't understand.
2. Discourage snide remarks, sarcasm, kidding and other class behaviors that may embarrass students.
3. Use diverse teaching activities to address a broad spectrum of students.
4. Select readings and design activities that relate to the background of your students.
5. Provide extra material or exercises for students who lack essential background knowledge or skills.
6. Integrate new knowledge about women and other under-represented populations into your courses.
7. Make explicit provisions for students who wish to carry out independent studies within your course or as separate courses.
8. Develop mastery learning contracts or computer-assisted learning alternatives for your courses.
9. Encourage your students to design their own majors when their interests warrant doing so.
9. Try to find out about your students' learning styles, interests, or backgrounds at the beginning of each course.

Conclusion

Whose Responsibility Is It?

Teachers and students hold the main responsibility for improving undergraduate education. But they need a lot of help. College and university leaders, state and federal officials, and accrediting associations have the power to shape an environment that is favorable to good practice in higher education.

What qualities must this environment have?

• A strong sense of shared purposes
• Concrete support from administrators and faculty leaders for those purposes
• Adequate funding appropriate for the purposes
• Policies and procedures consistent with the purposes
• Continuing examination of how well the purposes are being achieved

There is good evidence that such an environment can be created. When this happens, faculty members and administrators must think of themselves as educators. Adequate resources are put into creating opportunities for faculty members, administrators, and students to celebrate and reflect on their shared purposes. Faculty members receive support and release time for appropriate professional development activities. Criteria for hiring and promoting faculty members, administrators, and staff [reflect] the institution's purposes. Advising is considered important. Departments, programs, and classes are small enough to allow faculty members and students to have a sense of community, to experience the value of their contributions, and to confront the consequences of their failures.

States, the federal government, [sponsoring institutions], and accrediting associations affect the kind of environment that can develop on campuses in a variety of ways. The most important is through the allocation of financial support. States [and boards] also influence good practice by encouraging sound planning, setting priorities, mandating standards, and reviewing and approving programs. Regional and professional accrediting associations require self-study and peer review in making their judgments about programs and institutions.

These sources of support and influence can encourage environments for good practice in undergraduate education by:

- Setting policies that are consistent with good practice in undergraduate education
- Holding high expectations for institutional performance
- Keeping bureaucratic regulations to a minimum that is compatible with public accountability
- Allocating adequate funds for new undergraduate programs and the professional development of faculty members, administrators, and staff
- Encouraging employment of under-represented groups among administrators, faculty members, and student service professionals
- Providing the support for programs [and] facilities, [including the] financial aid necessary for good practice in undergraduate education

To order copies of "Inventories of Good Practice in Undergraduate Education," write to The Johnson Foundation, Inc., Processing Center, P.O. Box 17305, Milwaukee, WI 53217.

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Selecting and Evaluating Digital Learning Materials for Engineering Education

Questions to Consider When Selecting Courseware or Software

Good Practices in Undergraduate Education

1. Does this courseware encourage:
   - student-faculty contact?
   - cooperation among students?
   - active learning?

2. Does this courseware give prompt feedback or provide opportunities for students to get it from instructors or peers?

3. Does this courseware emphasize time on task?

4. Does this courseware help me communicate high expectations of my students?

5. Does this courseware address diverse learning styles?

Goals of Higher Education

1. Does this courseware support my teaching goals regarding
   - higher order thinking skills
   - basic academic and communication skills
   - discipline-specific knowledge and skills
   - liberal arts and academic values
   - work and career preparation
   - personal development

Practical Matters

1. Can students easily grasp how to use this courseware?

2. Do students have access to the necessary support for using this courseware? (internet access, correct software, etc.)

3. Does this courseware work reliably?

4. How much technical support will it take to support this courseware? Do I have access to the necessary support?

5. How much time will it take for me to learn how to use this courseware? Do I have the time to do so?

6. What will it cost me?

7. Is this the best tool/process to help my students meet the learning objectives for this course?

Introduction to Evaluating, Selecting and Using Learning Technologies and Digital Learning Materials

Brandon Muramatsu
NEEDS/UC Berkeley

Joseph Tront
SUCCEED/NEEDS/Virginia Tech

Flora McMartin
MERLOT

Jean-Pierre Bayard
CSU Sacramento

Dr. Jean-Pierre R. Bayard
Professor of Electrical & Electronic Engineering
California State University, Sacramento
6000 J Street
Sacramento, CA 95819-6019
Tel: (916) 278-5847
Fax: (916) 278-7215
bayardj@csus.edu

Mr. Brandon Muramatsu
SMETE/NEEDS Project Director
University of California, Berkeley
3115 Etcheverry Hall
Berkeley, CA 94720-1750
Tel: (510) 643-1817
Fax: (510) 643-1822
mura@needs.org

Dr. Flora McMartin
MERLOT Director of Members Services And Evaluation
mcmartin@merlot.org

Dr. Joseph G. Tront
Professor of Electrical and Computer Engineering
Virginia Tech
359 Durham Hall
Blacksburg, VA 24061-0111
Tel: (540) 231-5067
Fax: (540) 231-3362
jgtront@vt.edu

Review Criteria

- ***Premier Award* Criteria**
  - Developed in 1995-1997, refined in 1998
  - Used for six years in the *Premier Award* competition
  - Designed and used to find the "best of the best"
- **MERLOT-Engineering Evaluation Standards for Engineering**
  - Develop 2001
  - Based upon core MERLOT standards
  - Applied in MERLOT's peer review process

2

First competition in 1997

Goal to identify and reward the authors of high-quality, non-commercial courseware designed to enhance engineering education

Premier Award is about the entire experience of using the courseware by learners, not just the courseware itself

Disseminated over 10,000 CD's in the last four years

Judging and Review Process

- **Convene Judging Panel**
  - Professors and content experts, students, instructional designers, publishers
- **Review supporting material in the submission packet**
  - Author supplied responses to criteria
  - Evidence of student learning and evaluation
  - Testimonials
- **Review and test the courseware**

Premier Award

4

Premier Award Criteria: Instructional Design

Does the courseware enhance learning?

- **Learning Objectives**
  - Learning objectives are clearly stated and supported by the software.
- **Interactivity**
  - The learner is actively involved in the learning process—the interaction enhances learning.
- **Cognition/Conceptual change**
  - Learning appears to be significant and long lasting, and strong and useful cognitive models can be built.
- **Content**
  - The content is well chosen and structured.
- **Multimedia use**
  - Multimedia is used effectively and promotes the learning objectives and goals.
- **Instructional use/Adaptability**
  - The software can be used in a variety of settings.

5

Premier Award Criteria: Software Design

Is the courseware well designed and usable?

- **Engagement**
  - The software holds the interest of a diversity of learners.
- **Learner Interface and Navigation**
  - The software is easy to use.
- **Technical Reliability**
  - The software is free from technical problems.

6

Premier Award Criteria: Content

Is the content appropriate and well presented in the courseware?

- **Accuracy of Content**
  - The content is accurate and error free.
- **Appropriateness**
  - The content is appropriate for the scope of the *Premier Award*.

7

Selection Criteria

Premier Award for Excellence in Engineering Education Courseware

The criteria described below reflect the values associated with good teaching practices and pedagogy that we wish to promote and guide the selection of the *Premier Award for Excellence in Engineering Courseware*. The criteria are divided into three categories: instructional design, software design, and engineering content. Each category is described by a set of components and sub-components. The entire learning experience of using the software, as well as the materials in the submission packet, should demonstrate that the submission meets (and hopefully exceeds) the criteria by addressing each component and sub-component.

Scoring for Instructional Design and Software Design

- Scoring is done on a seven point scale from 1 = poor to 7 = excellent.
- To earn four (4) points for a given category, the software must address each of the sub-components in Part 1 of that category.
- To earn a score of five to seven (5-7), most, if not all, of the applicable sub-components in Part 2 of each category must be addressed.
- If any of the sub-components in Part 2 have not been addressed, that component cannot receive a score higher than a four.

Scoring for Engineering Content

- Engineering Content is scored differently from the other two categories, it is scored to reflect its accuracy and appropriateness for the *Premier Award.* Engineering content is evaluated by the judges' agreement with the statements listed: Strongly Disagree, Disagree, Agree and Strongly Agree.
- If any judge evaluates the statements as Strongly Disagree or Disagree the software cannot be considered for the *Premier Award* or as a finalist candidate.

The sub-components relate to the scale in such a way as to ensure the excellence of the winners. Winning software need not address all sub-components specifically, since not all components are appropriate for each type of courseware. For example, a piece of software may not include a simulation; as a result, not all components dealing with user feedback are appropriate. We expect the software selected for the *Premier Award* will address most, if not all, of the applicable components in an exemplary manner.

1.0 INSTRUCTIONAL DESIGN

1.1 Learning Objectives: Learning objectives and goals are clearly stated and supported by the software and learning experience.

Part 1:

- Learning objectives and goals are appropriate and clearly stated, in the software (preferred) in an instructor's guide or the submission packet.
- The presentation and organization of content, as well as related activities, supports the learning objectives and goals.

Part 2: *Support for Learning Objectives is enhanced if:*

- Learners are aware of learning objectives as they are using the software and participating in the learning experience.
- A clear method of measuring achievement of learning objectives and goals is provided within the software or by the learning experience.
- Learning objectives and goals can be correlated to ABET accreditation criteria.

1.2 Interactivity: The learner is actively involved in the learning process—the interaction enhances learning.

Part 1:

- The software responds appropriately to learner actions.
- Communication is 2-way.
- Learners control their own pace and are informed of their progress so they can make appropriate decisions about how to proceed.
- Choices that learners make are meaningful and not "just for the sake of making choices".

Part 2: *Interactivity is enhanced if:*

- Learners decide: what they want to learn; in what order; and how deeply they want to concentrate on specific topics.
- The learner can select the type of media that she wants to use (e.g., audio, transcript, etc.).
- There are questions and challenges to help the learner monitor his or her progress.
- Learners are presented with relevant problems to solve; exemplary solutions are included.
- There is an analysis of learner input and useful, appropriate feedback.
- The system adapts its delivery style or content based on learner actions.

1.3 Cognition/Conceptual Change: Learning appears to be significant and long lasting—strong and useful cognitive models can be built.

Part 1:

- It appears that learners will be able to demonstrate or apply the concepts introduced by the software in meaningful ways.
- It appears that learners will be able to transfer what they've learned to areas beyond what is specifically covered in the software.
- The software encourages and supports reflection, deep thinking, knowledge integration, and making connections.

Part 2: *Cognition/Conceptual Change is enhanced if:*

- The software has been tested with real learners and there is evidence that it enhances learning.
- Learners are encouraged to make predictions; provide self-explanations; or to analyze, synthesize or reorganize the information.
- Mechanisms are provided so learners can monitor their own understanding and correct their misconceptions or poorly developed mental models.

1.4 Content: The content is well chosen and structured.

Part 1:

- The scope of the content is appropriate for the intended learning objectives and intended audience.
- There is a default sequencing of material that makes sense for learning (i.e., concepts build upon each other and are presented in a clear, logical manner).
- The structure of the knowledge to be learned is clearly conveyed.
- The content builds on prior knowledge that learners can be expected to have; the required background knowledge is clearly stated or understood.

Part 2: *Choice and Structure of Content is enhanced if:*

- There are useful links between content areas.
- The organization facilitates the user's exploration of the area of knowledge both inside and outside the learning experience.

1.5 Multimedia use: Multimedia is used effectively and promotes the learning objectives and goals.

Part 1:

- None of the multimedia representations used are ambiguous, lead to serious misconceptions, or are likely to be misinterpreted by learners.
- Media is used appropriately and not gratuitously.
- Multiple representations are used to help learners construct inter-related knowledge.
- Media elements are of high visual and aural quality.

Part 2: *Multimedia use is enhanced if:*

- Multiple media types support each other. For example, text transcripts are available for audio data, or audio data narrates animation(s).
- Multimedia elements are clearly labeled, so the learner doesn't have to struggle to figure out what they are looking at, or why the element is there. The software has multimedia elements that in themselves are interactive (e.g., learner can interact with animation of a system, by pressing buttons or moving levers, etc.).

1.6 Instructional Use/Adaptability: The software can be used in a variety of settings.

Part 1:

- Instructions or an instructor's guide clearly explains how this software should be used to be effective, and who is expected to use the software.
- The intended use is not so narrowly defined that only a select few could use this software.
- There are suggestions in the instructors' guide or mechanisms in the software to assess learning.

Part 2: *Instructional Use/Adaptability is enhanced if:*

- The software provides different use levels (beginner, intermediate, expert).
- Help functions and guides are provided.
- There are instructor configurable software settings.
- There are clear suggestions for alternate uses in the instructors' guide, or easily identifiable alternate uses.
- This software has potential to improve the way instructors spend their time.

2.0 SOFTWARE DESIGN

2.1 Engagement: The software holds the interest of a diversity of learners.

Part 1:

- The software is stimulating and challenging.
- The software does not contain stereotypes (racial, gender, ethnic, age).
- Speed of software is satisfactory.
- The software is visually appealing and attractive in the design of its screens.

Part 2: *Engagement is enhanced if:*

- The learner would use it more than once.
- There are learner-tailorable interface settings.
- There is consideration for learners with physical impairments.
- The software promotes diversity and gender equity.

2.2 Learner Interface and Navigation: The software is easy to use.

Part 1:

- The software is consistent in its design and response to learner actions.
- The learner will not get confused about how to proceed.
- The learner can form a mental map of where they are and how to get around in the software (e.g., through an explicit map or because the software is simple enough).

Part 2: *Learner Interface and Navigation is enhanced if:*

- Icons and graphical symbols are clear and unambiguous.
- There are multiple forms of navigation (e.g., table of contents, next/previous, index, and search).
- Screens can be viewed without scrolling.
- Text on screens is appropriately scaled and cannot be erased.

2.3 Technical Reliability: The software is free from technical problems.

Part 1:

- There are no obvious software bugs.
- There are no interface problems (e.g., all buttons function, screen graphics are displayed and updated appropriately, text on screens cannot be erased and/or are not cut off, etc.)
- Software crashes occur very rarely, if at all.

Part 2: *Technical Reliability is enhanced if:*

- Screens can be viewed without scrolling.
- Text on screens is appropriately scaled and cannot be erased.

3.0 ENGINEERING CONTENT

3.1 Accuracy: The content is accurate and error free.

3.2 Appropriateness: The content is appropriate for the scope of the Premier Award.

MERLOT
Evaluation Standards for Engineering

The following information is provided for users, developers, and new reviewers of MERLOT-Engineering materials to help them better understand the criteria used to evaluate materials in the database. The criteria used in the peer review process are intended to help users select materials which meet their needs and to aid authors in the development of quality materials for the MERLOT database.

There are three general categories of evaluation standards:

1. Quality of Content
2. Potential Effectiveness as a Teaching-Learning Tool
3. Ease of Use

Though the three categories are interdependent to some extent, separate ratings are assigned to each on a 1 to 5 scale. Materials are given a rating of 3 if they are considered useful at a basic level. Materials that satisfy two or three of the main criteria in each evaluation category are given a rating of 4, and materials that satisfy most of the main criteria are given a rating of 5.

Reviews with ratings of 3 or above are posted on MERLOT. Reviews with lower ratings are not posted, but are sent back to the authors for their information and potential revision.

At least two reviewers are assigned to each material reviewed. Each reviewer performs an individual review, discusses it with the other reviewer, and together they produce a final composite version. Authors see all reviews before they are posted and have an opportunity to respond to the review or to request that it not be posted.

QUALITY OF CONTENT

1. Does the material present valid concepts, models, collections, and/or results?

2. Does the material present important engineering concepts, models, or collections?

   a. Is the content part of the core curriculum in the specific engineering discipline?
   b. Is the content a prerequisite for more advanced material in the discipline?
   c. Does the material stay on target?
   d. Does the material appear to be difficult to teach or learn?

3. Does the material make effective use of graphics and multimedia?

   a. Are the graphics or media attractive?
   b. Do the graphics or media contribute to a better understanding of the engineering.

POTENTIAL EFFECTIVENESS AS A TEACHING-LEARNING TOOL

1. Does the material improve faculty's abilities to teach and students' abilities to learn the concepts it addresses?

    a) Does the material effectively demonstrate the engineering concepts it addresses?
    b) Does the material make difficult engineering concepts more understandable?
    c) Is the material a learning tool and not just an entertaining diversion?
    d) Does the material help develop problem solving skills?

2. Can the material be used in a variety of ways to achieve teaching and learning goals?

    a) Can the material be readily used in the classroom to supplement lectures?
    b) Can the material be readily incorporated into homework assignments?
    c) Can the material be readily used for group assignments?
    d) Can the material be readily used for laboratory assignments?
    e) Can the material be readily used in a tutorial fashion?

3. Can the material be readily integrated into an engineering curriculum?

    a) Does the material enhance standard presentations of engineering concepts?
    b) Can the material be used with standard textbooks or problems?
    c) Can the material be used in a nontraditional manner?

4. Are the teaching-learning goals and consequent uses easy to identify?

    a) Are the teaching-learning goals readily identifiable?
    b) Are uses for the material readily identifiable?

5. Can good learning assignments that use the material be written easily?

EASE OF USE

1. Is the material convenient and inviting to use?

    a) Is the software easy to enter and exit?
    b) Is the material attractive and inviting to use?
    c) Would someone likely become lost or confused while using the material?
    d) Can the material be used with minimal documentation or instruction?
    e) Is the software robust enough to minimize the risk of a crash?
    f) Is the background of the expected user clearly indicated?

2. Is the layout of the material consistent and intuitive?

a) Does the material present information in ways that are familiar to engineering faculty and students?
b) Are labels, buttons, and other interface elements fully functional, consistent, and intuitive?

3. Does the software provide appropriate feedback?

a) Is appropriate feedback provided about system status and user responses?
b) Is feedback sufficiently rapid to be useful?

4. Does the software provide appropriate flexibility in its use?

a) Can the material be used by faculty and students with different levels of experience with computers and the web?
b) Is the material adaptable to different internet connection speeds?
c) Is the material free of any special software requirements such as difficult to obtain plug-ins, media players, browser type, etc.?

--- Adopted December 3, 2001 ---

