

Computer Game Programming Engines for Computational Science Curriculum Development

**SUNY Brockport
BuffaloNY 10Aug2006**

Dr. Kris Stewart

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San Diego State University**



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SDSU is an MSI (kinda)

Curriculum development –

CS575 Supercomputing for the Sciences

Based on SDSC Summer Institute workshop and computing resources from SDSC

Most recent curriculum – Spr 06

3d Game Programming for Simulation (Torque)

NSF EPIC research project and collaboration with SDSC Visualization (S Cutchin)

<http://www.stewart.cs.sdsu.edu/cs596.html>



Resources:



4CNet

California State University and California Community Colleges



CaIREN -2...

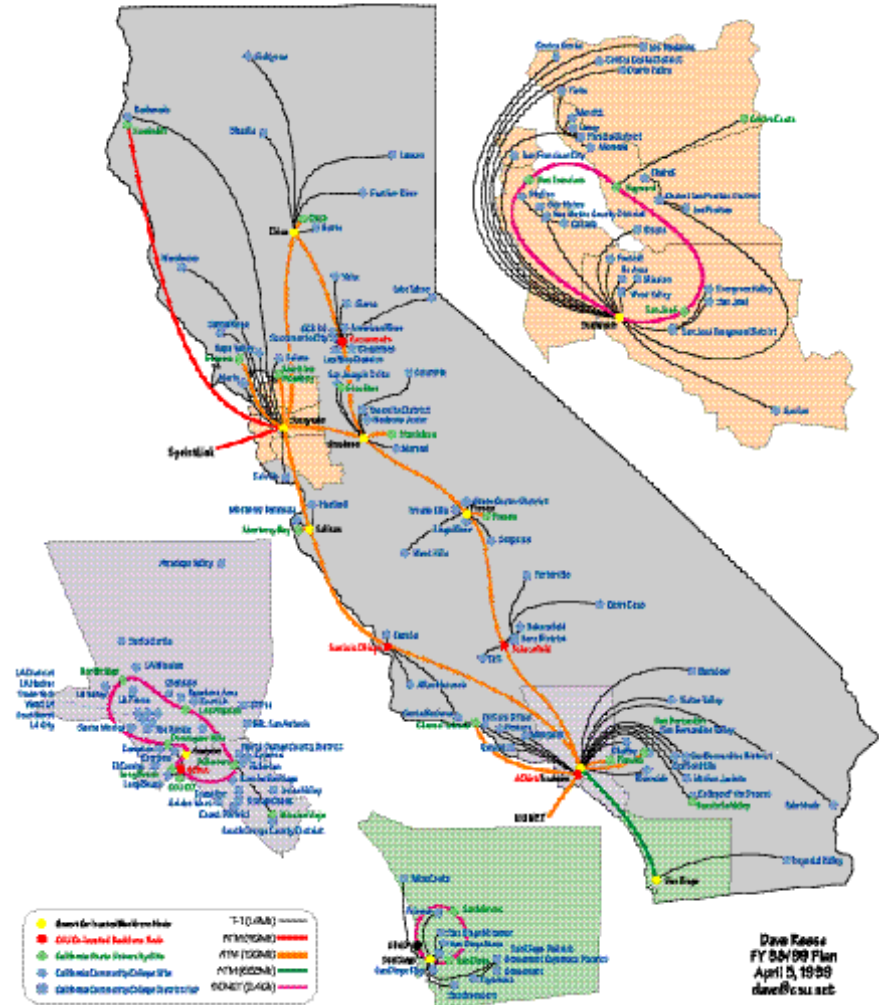


Corporation for Education Network Initiatives in California

Digital California Project



San Diego Supercomputer Center



Dave Kees
FY 98/99 Plan
April 3, 1999
dave@csu.ucd

CDL CALIFORNIA DIGITAL LIBRARY
A Co-Library of the campuses of the University of California



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Kris' Faculty Background

(Kris Stewart, CS Professor, San Diego State University, California State University)

- **Numerical Analyst* led to**
- **Supercomputing and Undergraduate Education (SUE**) led to**
- **Supercomputing Teacher Enhancement Program (STEP***) led to**
- **Education Center on Computational Science & Engineering (EC/CSE) part of EOT-PACI (1997)**
- **ECCSE joins Engaging People in Cyberinfrastructure (EPIC) led to 3d Game Programming**

* MS/CS SDSU 1979 (built IMSAI/Z80 kit computer),
JPL 1981, PhD UNM 1987, SDSU 1984

** SDSC (1991); UCES (DoEnergy 1994)

*** Smithsonian Research Collection (1996)



3d Game Programming

Upper Division Course for Coders

- Using the Torque Game Engine from www.garagegames.com



- Torque is an object oriented scripting language with an extensive library of game capabilities
- Text: Ken Finney, Thomson Pub



3d Game Programming Spr 06

- <http://www.stewart.cs.sdsu.edu/cs596.html>
- **The first offering of this course was Spr06 and the course will be reoffered Spr07. The class web page will be updated for the next offering during Fall 06. Please check back on this evolving curricular development.**



Game Programmer's Guide to Torque *Spr07*



by Edward F. Maurina III

Windows, Macintosh, Linux





Features

- **Step-by-step examples demonstrate how to use the engine to its full potential.**
- **Detailed system descriptions clearly explain how Torque and other game engine work.**
- **Full Torque Game Engine demo included on the CD offers all you need to get started making games on your own. My grant-overhead \$ will purchase the site license for the student lab.**
- **In-depth references provide quick look-ups for engine classes, subsystems, and script functions.**
- **Lesson kit included on CD allows you to learn at your own pace.**
- **Over 500 additional pages off appendices on CD provide fast, searchable references and information on game development and Torque.**



Guidance from the Text

Part 1: Introduction

Part 2: Engine Overview

Torque from 10,000 Feet

Torque Tools

Introduction to TorqueScript

Part 3: Game Elements

Torque Core Classes

Basic Game Classes

Gameplay Classes

Mission Objects

Game Setup Scripting

Gameplay Scripting

Special Effects

Standard Torque Game Engine GUI Controls

Game Interfaces

Part 4: Making the Game

Putting it all Together – Your own game



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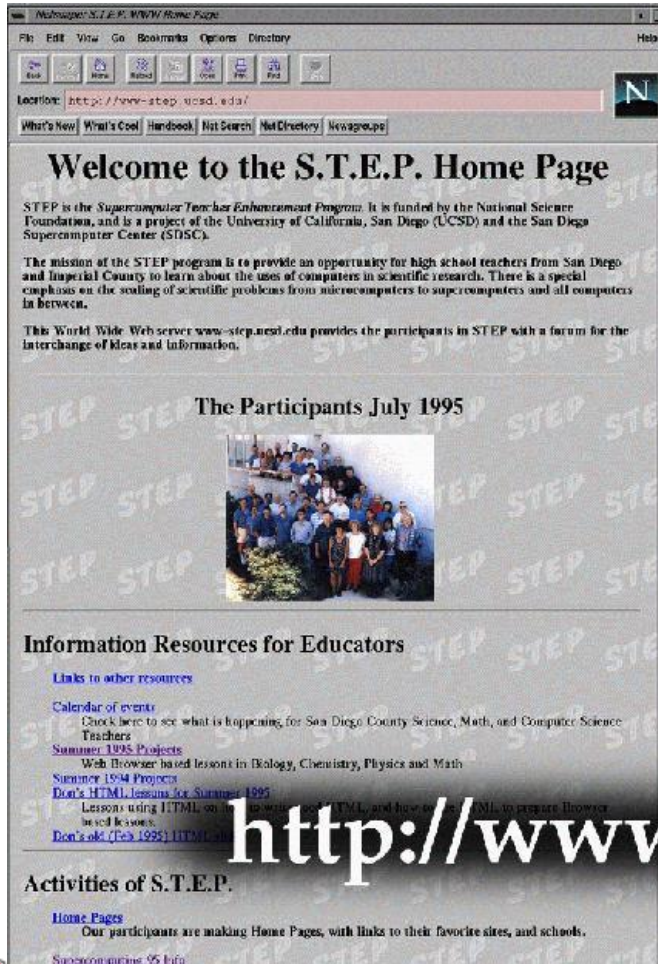


How the Ed Center on CSEng has used Torque

- **Hoover High School collaborators, Mr. Hal Cox (physics) and Mr. Robert North (chemistry)**
- **Both former STEP teachers**
 - Supercomputer Teacher Enhancement Program (1993-1996)
 - Key point was the adoption of Web Browser in school curriculum in 1994
 - Support from local infrastructure for network/computers in the classroom

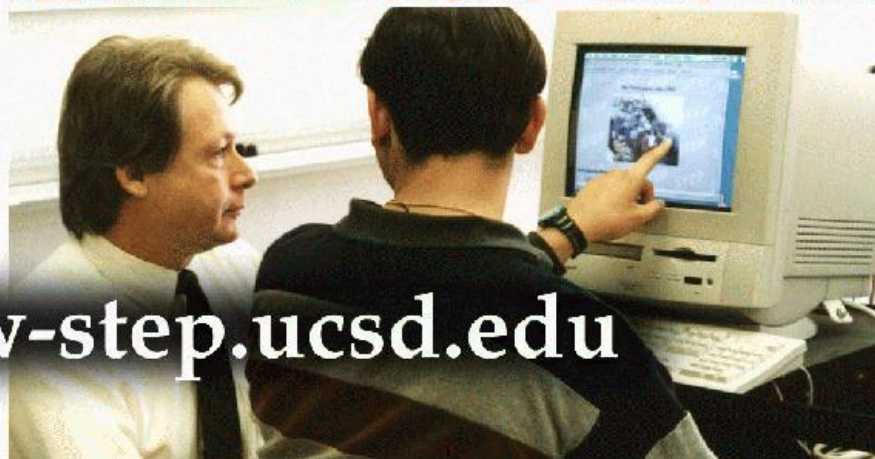


1996 ComputerWorld/Smithsonian InfoTech Award for STEP



<Robert

<Hal



<Robert



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Web Page Development Adopted Quickly (wouldn't you prefer to have this young man on campus in the computer lab, than ...)



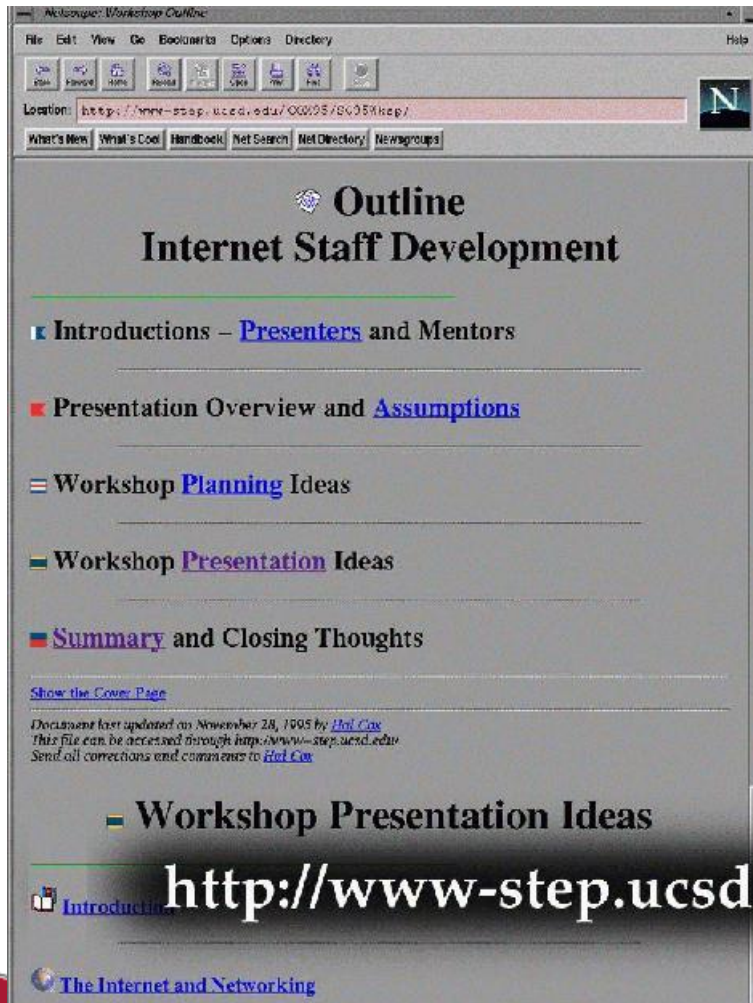
<http://www-step.ucsd.edu/projects95.html>



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STEP Lead Teachers (Hal Cox)



Netscape: Workshop C95Wksp

File Edit View Go Bookmarks Options Directory Help

Location: <http://www-step.ucsd.edu/COX95/SC95Wksp/>

What's New What's Cool Handbook Net Search Net Directory Newgroups

Outline Internet Staff Development

- Introductions – [Presenters](#) and Mentors
- Presentation Overview and [Assumptions](#)
- Workshop [Planning](#) Ideas
- Workshop [Presentation](#) Ideas
- [Summary](#) and Closing Thoughts

[Show the Cover Page](#)

Document last updated on November 28, 1995 by [Hal Cox](#)
This file can be accessed through <http://www-step.ucsd.edu/>
Send all corrections and comments to [Hal Cox](#)

■ Workshop Presentation Ideas

[Introduction](#)

[The Internet and Networking](#)



<http://www-step.ucsd.edu/COX95/SC95Wksp/>

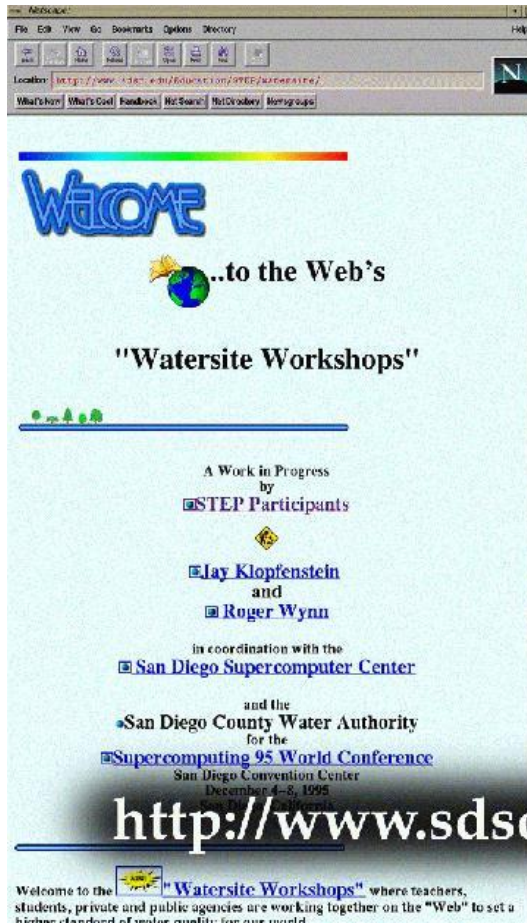


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Computing Power a Decade Ago

(look familiar to you, or were you born digital?)



California State Standard Exam Topic

5n: Electric and Magnetic Phenomena

Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept: *n Students know* the magnitude of the force on a moving particle (with charge q) in a magnetic field is $qvB \sin(a)$, where a is the angle between v and B (v and B are the magnitudes of vectors v and B , respectively), and students use the right-hand rule to find the direction of this force.

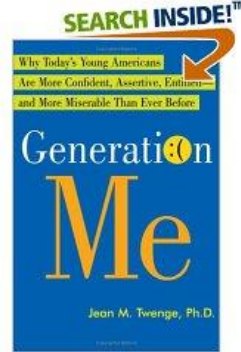
[<http://www.cde.ca.gov/be/st/ss/scphysics.asp>]



2006 - We in Computational Science are Indebted to the Gamers

- **The Power They Needed to Effectively Run Interactive Games pushed the CPU Envelope**
- **The Resolution in Graphics and Run-time Response has Engaged this Audience (market-driven, video games more than DVD movies)**
- **We in Higher Ed Need to Engage this Audience**
- **We can Tune the Curriculum to Benefit our Students and a Larger Audience**
- **Service-based Learning is Rewarding to the Spirit (*may not know they need this*)**





Generation ME

- **Why Today's Young Americans are more Confident Assertive and more Miserable than ever before**
- **Jean M. Twenge, PhD, (Psychology Dept SDSU) & possible new collaborator ?**



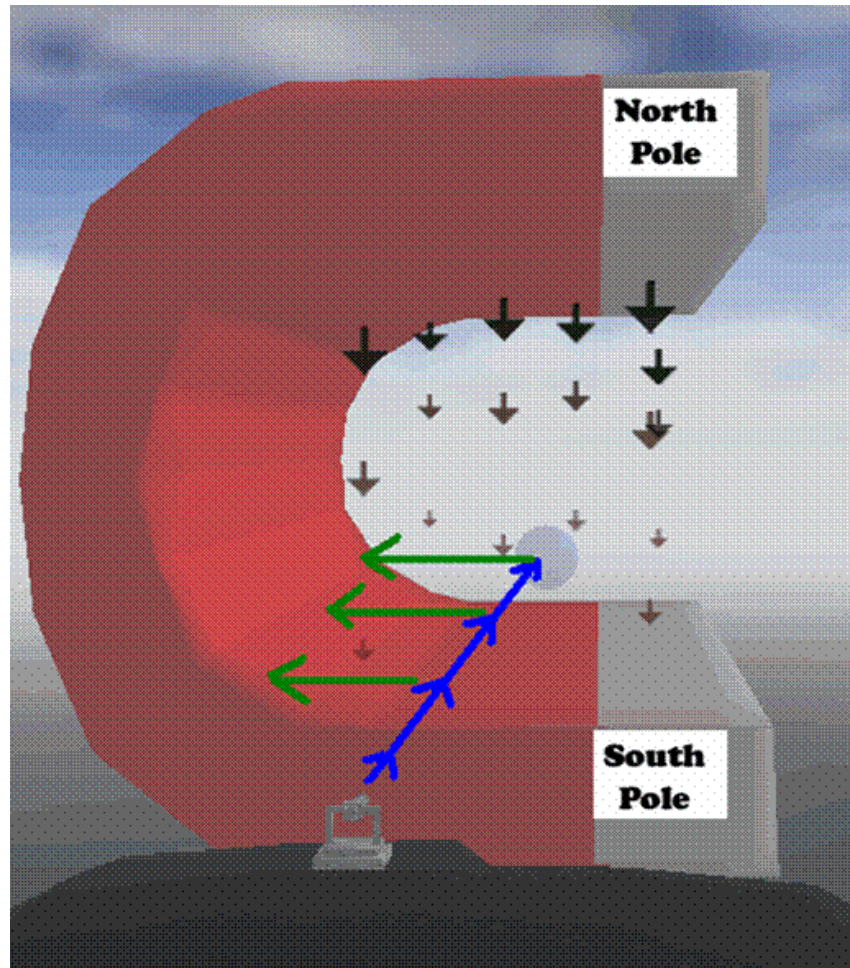
ECCSE collaboration with Steve Cutchin

SDSC <http://vis.sdsc.edu/>

- <http://visservices.sdsc.edu/projects/explore/> hosts our Chemistry and Physics modules



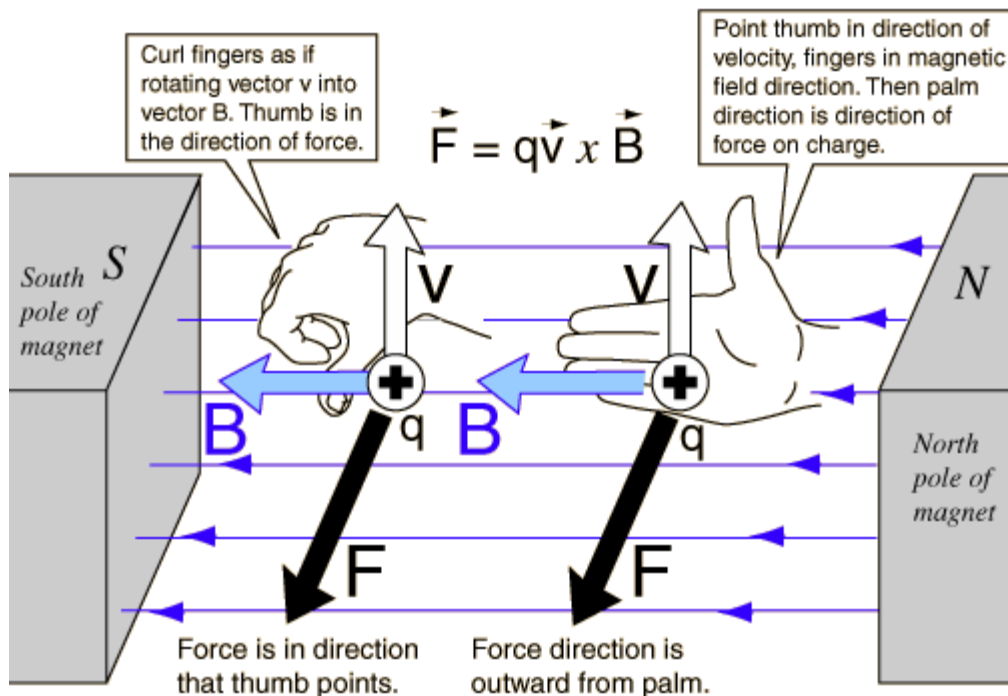
Magnetic Particle Emitter



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Directions – Right Hand Rule/Left Hand Rule



Live Demonstration?

- **Fingers crossed the Dell Notebook is fast enough**
- **Fingers crossed the projector is fine enough**

- **Start the Game (tab for avatar)**
- **Proceed slowly to read the background information**



Comic-Con – A new Opportunity?

- **KPBS interview with Azumi creator**



Ryuhei Kitamura @ Comic-Con

Last Month in San Diego



Azumi – “I want to make samurai version of *Mad Max*”

<http://www.publicbroadcasting.net/kpbs/arts.artsmain?action=viewArticle&pid=31&sid=8&id=948591>

I have it ordered from Amazon.com – should be there when I return to San Diego



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Fall 06 Teaching at SDSU

- **CS 440 Social and Ethical Issues in Computing**

Cyberethics: Morality and Law in Cyberspace, Richard A. Spinello, Jones and Bartlett Pub., 2006 – reading on the plane ride

- **CS 524 Compiler Construction**


Fundamental CS – Lex, Yacc as tools. Student project will extend a *bare-bones* compiler to recognize Ada (semester long)

These courses provide validation for this *digital immigrant* for Spr 07 3d Game Programming



More Outside Wisdom – JSB

John Seely Brown – 17Jan05 @ SDSU



**GROWING UP
DIGITAL**

*How the Web Changes Work,
Education, and the Ways People Learn*

By John Seely Brown

In 1831 Michael Faraday built a small generator that produced electricity, but a generation passed before an industrial version was built, then another 25 years before all the necessary accoutrements for electrification came into place—power companies, neighborhood wiring, appliances (like light bulbs) that required electricity, and so on. But when that infrastructure finally took hold, everything changed—homes, work places, transportation, entertainment, architecture, what we ate, even when we went to bed. Worldwide, electricity became a transformative medium for social practices.

John Seely Brown is the chief scientist of Xerox and director of its Palo Alto Research Center.

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JSB

www.johnseelybrown.com

- **Having the credentials that a computer science geek respects (Chief Scientist, Xerox; Director Xerox PARC)**
- **Having publications that the education community validates (he joined the HBR debate on “IT matters to Higher Ed”^{*} in letter to editor)**

***HBR May 2003 IT Doesn't Matter – Nicholas G. Carr**

***Does IT Matter to Higher Education? – Jack McCredie, Educause Review Nov02**



What's Next?

- **CS440 being taught Fall 2006**
Expect interesting feedback from students on their opinions on the *Digital Age*, given they were *born digital*
- **Applaud you for embracing CSE and now challenge to ensure awareness of IT in higher education**
- **Expect interesting changes in the learning environment and its support on campus, through evidence gathered using Online Tools**



Assessment not just requirement

Rather, found to be

- **vital tool to assist in clarifying student and faculty needs**
- **improve prioritization skills**
- **validation of focus on human factors to integrate HPC (modeling & visualization) into undergrad curriculum**

U. Wisconsin LEAD for 1998/99 Ed Center evaluation

www.cae.wisc.edu/~lead/pages/products/eot-paci.pdf



Lessons Learned

- **Network brings resources to YOUR desktop (or lab or class)**
- **Computer network is community resource with individual opportunities & responsibilities**
- **Efforts within your local environment to raise awareness, but must credit the external source**
- **National partnerships, EPIC, EOT-PACI and this workshop. Voices that local colleagues listen to (more than you)**



Grid Curriculum – Mary Thomas



Introduction to Grid Computing

rohan.sdsu.edu/faculty/mthomas/courses/spring05/cs696/index.html (all on 1 line)



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Next Step for You

- **Participating in this workshop is excellent to learn first-hand of the resources**
- **Attend SC06, join plans for SC07-09 (thanks Scott Lathrop)**
- **Assessment is important (for you, your peers, your students) to demonstrate value**



Where did it begin?

1998/99 Assessment by LEAD

Background

- **Workshop in Wisconsin April 1997 to learn about assessment and make it real to the EOT-PACI (NPACI and NCSA Education Teams)**
- **NPACI started 01 October 1997**
- **EC/CSE requested assessment for 1998 project**



NSF/EHR

National Science
Foundation/Education and
Human Resources
Directorate

[http://www.nsf.gov/pubs/
2002/nsf02057/start.htm](http://www.nsf.gov/pubs/2002/nsf02057/start.htm)

LEAD

Assessment and
Evaluation

1998 Formative for the
ECCSE

<http://homepages.cae.wisc.edu/~lead/pages/products/eot-paci.pdf>



1. [Introduction](#) (46kb)
2. [Section I - Evaluation and Types of Evaluation](#) (55kb)
3. [Section II - The Steps in Doing an Evaluation](#) (154kb)
4. [Section III - An Overview of Quantitative and Qualitative Data Collection Methods](#) (66kb)
5. [Section IV - Strategies That Address Culturally Responsive Evaluations](#) (50kb)
6. [Other Recommending Reading, Glossary, and Appendix A: Finding An Evaluator](#) (56kb)



[Entire PDF Document](#) (379kb)

Updated NSF User-Friendly Handbook



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Grand Challenges for HPC

Stewart & Zaslavsky, SC98,

HPC=High Performance Computing

- 1. Faculty system of rewards does not encourage teaching innovations**
- 2. Lack of awareness of HPC technologies already used in research or teaching for different fields**
- 3. Faculty & students unaware of benefits and accomplishments of HPC**
- 4. HPC technologies considered too complex/inaccessible for undergraduate instruction**
- 5. Sequential HPC-related curricula is absent**
- 6. Curricula using very large data sets not widely available**
- 7. Adjust to different learning styles when material is complex**
- 8. Variety of platforms/software leads to fragmented curricula**
- 9. School administration/support staff not ready for HPC**
- 10. Specs of computers and networks below user expectations**

We had been thinking about this (based on April 97 LEAD Workshop in WI)



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Building the Community of Faculty

- **These challenges are people-centric, not technology-centric and of interest to the broad academic community**
- **Systemic Change requires understanding the system and working within it**
- **Empower faculty (find the time), ensuring recognition (from chair/dean) and support (student assistants)**



Undergraduate Faculty: A Tough Target Group

- **Obstacles:** lack of time, tenure and review considerations, lack of awareness about available technologies
- **Undergraduate faculty (SSRL phone survey 1997 – thanks Doug Coe):**
 - $\frac{3}{4}$ have used WWW often or sometimes (1997), but not in the classroom (only 18% - 1998)
 - The gap between those NEVER using computers in the classroom, and those using them OFTEN, is the largest for untenured faculty, increasing towards tenure review
 - Only 12% of surveyed faculty saw themselves as having a use for HPC applications in courses (higher for Sciences and Engineering)
 - 11% of faculty have students working with computer models OFTEN



Strategies for Building Faculty Community

- Reliance on most enthusiastic and technically advanced instructors who are already using computing and modeling in classes
- **The Faculty Fellows program:**
 - **Stakeholders:**
 - College Deans - Specific support through faculty release time
 - Faculty - Compensation, and acknowledgement, of the value of the faculty members contribution
 - **Benefits**
 - College
 - Department (Faculty Fellows as discipline-specific spokespersons for EC/CSE and NPACI)
 - Faculty (as individuals)
 - Ed Center on Computational Science and Engineering
 - **Building a special infrastructure for curriculum transformation: human, institutional, technical – is a requirement for successful introduction of advanced techniques (since they are more demanding on faculty time and efforts)**



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Faculty Fellows during 1998-2004

- **Faculty Fellows representing departments from five colleges and the Library: Geological Sciences, Geography, Linguistics, Library & Info Access, Music, Education Technology, Biology, Computer Engineering, Computer Science, Business Information Systems**
- **Bi-weekly meetings at the Ed Center**
- **Faculty Fellows as “ambassadors” of computational science**
- **Partnership with LEAD for evaluation during 1998-99**



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Faculty Fellows Fall 01 Synergy

among themselves and with their chairs and deans

**People, Time, Support,
Recognition ...**



Lessons Learned from ECCSE

- Institutional support required for program to be sustainable
- Individual reform-ready faculty is focus for support
- Infrastructure:
 - Build a Synergistic Environment (across disciplines) for Faculty
 - Continuous monitoring through interviews, surveys, discussions



CS440 Learning Outcomes

CS 440 Social, Legal and Ethical Issues in Computing (SDSU Catalog)

Impact of computers, applications, and benefits, copyright, privacy, computer crime, constitutional issues, risks of computer failures, evaluating reliability of computer models, trade and communications in the global village, computers in the workplace, responsibilities of the computer professional.

CS 440 provides opportunities to study and better understand how our profession, Computer Science, contributes to our world. We will cover most of the text book through readings and class discussions. As the semester progresses, **you will be expected to develop your own answers to the following questions**, and provide evidence to support your answer:

How does society interpret the place of computers in an individual's life?

How does the computing professional respond to the expectations of society?

How can you start the Life-Long process to remain current in your field?

Required Activities:

- ♦ Readings from our text **A Gift of Fire: Social, Legal and Ethical Issues for Computers and the Internet (2nd ed.)** by Dr. Sara Baase.
www-rohan.sdsu.edu/faculty/giffire Author's WebPage
- ♦ **10 five-minute quizzes on assigned reading material** (be on time to class or you might miss one) **[10%] no make-up quizzes**
[Preliminary Reading Assignments for Spr05](#) [Authors Suggestions]
- ♦ **Participation in class discussions (attendance is counted) [20%]**
- ♦ **Student Book Report [20%]** [Book Report Assignment Details](#)
- ♦ **Student Term Paper [20%]** [Term Paper Details](#)
- ♦ **Student Critical Reading / Feedback on Another Student's Term Paper [10%]**
- ♦ **Final Exam [20%] 16May05 1-3pm**



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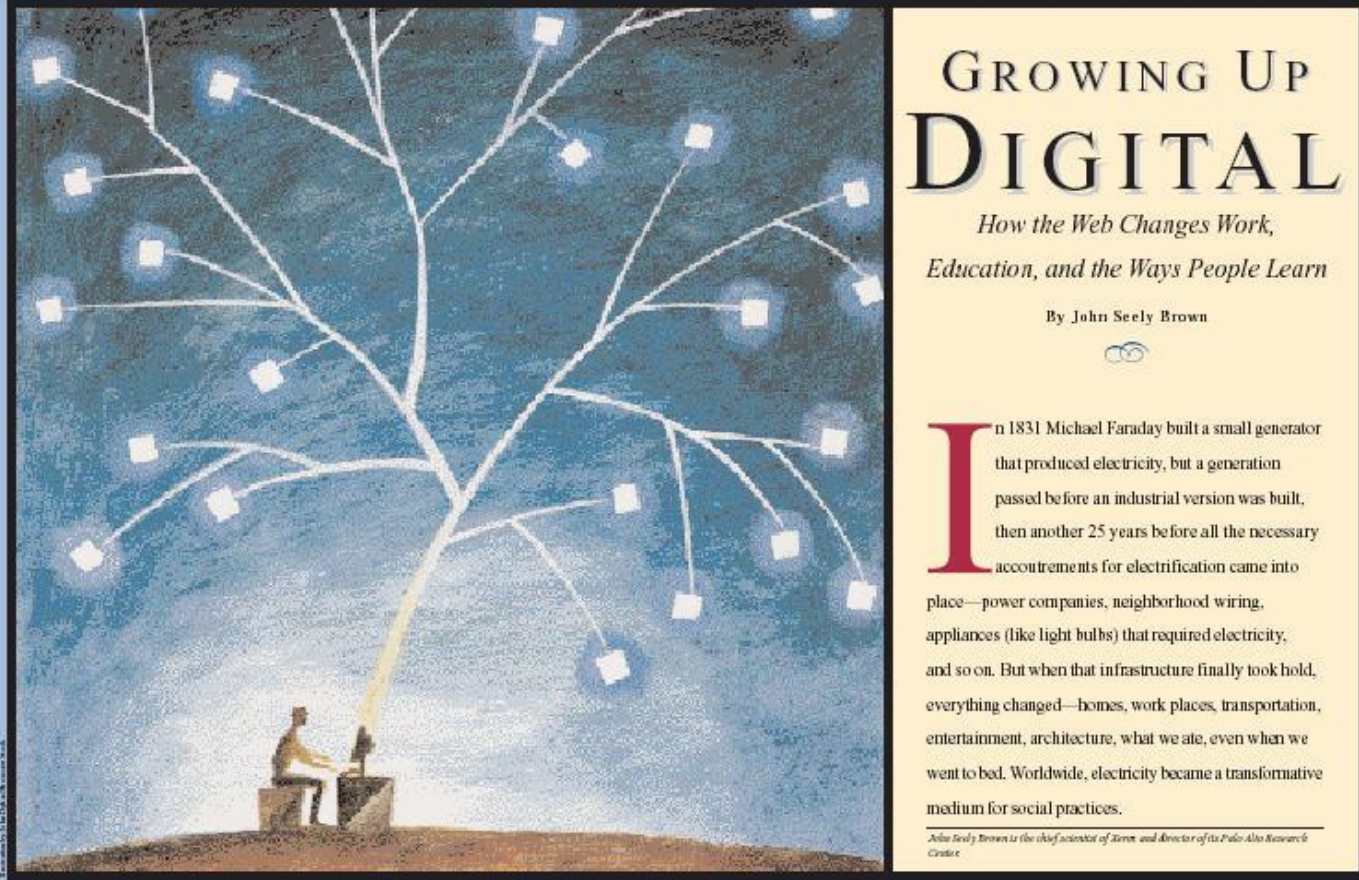
CS440 – Student develop your own answers (and justify them) to:

- **How does society interpret the place of computers in an individuals life?**
- **How does the computing professional respond to the expectations of society?**
- **How can you start the life-long process to remain current in your field?**



Again, Outside Wisdom – JSB

John Seely Brown – 17Jan05 @ SDSU



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Apply JSB Insights to CS 440

- **Students have grown up digital; faculty are analog**
- **Capitalize on creativity by honoring the vernacular of today's students (multimedia-literate)**
- **Communicate complexity simply (great skill)**
- **MIT's architecture studio – all work in public (development and critique) – in context**
- **Learning to learn “in situ” is key**



Apply JSB Insights to CS 440

early in the semester, just the start

- **JSB highlights**
multimedia literacy
- **CS440 Student Learning Outcomes**
student group presentations were great (but classroom venue was not up to it)



Evaluation and Assessment of Classroom Practice

Where to start?

- **User-Friendly Handbook for Project Evaluation: Science, Mathematics, Engineering and Technology Education, NSF 02-057**
- **Student Surveys - Need a compatible tool for instructor to examine results with**
- **Sociology WorkBench (SWB) developed by team of undergraduate computer science majors employed by the EC/CSE**



References – ICCSE Aug06

www.stewart.cs.sdsu.edu/PPT/stewart-sunyBrock_aug06.ppt
Ed Center on Computational Science & Engineering

<http://www.edcenter.sdsu.edu/>

Stewart Home Page: curricula

www.stewart.cs.sdsu.edu

John Seely Brown

<http://www.johnseelybrown.com>

NSF User-Friendly Handbook for Project Evaluation

<http://www.nsf.gov/pubs/2002/nsf02057/start.htm>

San Diego Supercomputer Center www.sdsc.edu

SDSC Education <http://education.sdsc.edu>



More Information?

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www.eotepic.org

This work supported by NSF 520146

www.nsf.gov/awardsearch/showAward.do?AwardNumber=0520146








Hobbies?

<http://www.stewart.cs.sdsu.edu/mypix>



Dwight Crum Pier-to-Pier Swim 2006

-  [Finish by Manhattan Beach Pier](#)
-  [We had surf at end \[Lifeguard\]](#)
-  [Kris wins her age group](#) [hurray for being 55!]
-  [Janet Beard](#) [with Hermosa Beach Pier in background]
-  [My Mom](#) (81, you go girl!)



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