

Teaching High Performance Computing Synchronously: A Survey of Experiences



Henry Neeman
 OU Supercomputing Center for Education & Research
 University of Oklahoma
 Katherine Kantardjief
 California State University, Fullerton
 Sandie Kappes
 National Center for Supercomputing Applications
 University of Illinois at Urbana-Champaign
 Laura McGinnis
 Pittsburgh Supercomputing Center
 Kathryn Traxler
 Center for Computation & Technology
 Louisiana State University

What is Synchronous Teaching?

Synchronous online instruction takes advantage of the "anywhere, anytime" aspect of the Internet. Although asynchronous modes of communication work well to meet some learning objectives, not every learning objective can be met without real-time interaction. Opportunities for real-time learning have been provided by rapid improvements in technology and Internet connectivity, increased comfort levels of educators who use and are willing to use these forms of communication, as well as instructional and technology support for those who utilize them.

Major educational functions served:
 Instruction – Collaboration – Support – Socializing – Informal exchange – Extended outreach

Modes of interacting with participants:
 Blogs – Wikis – Web Conferencing – Virtual Environments

Provides opportunities to:

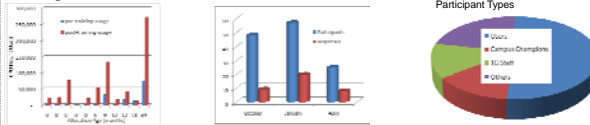
- give immediate access to peers, instructors and knowledge experts;
- facilitate interaction and sharing of ideas;
- provide direct connections to real situations and primary resources;
- demonstrate and assess skills and critical thinking in real time;
- include a diverse learner population; and
- separate training from geographic constraints

*What learning can we facilitate with the technology that we couldn't do otherwise?
 What can we do better?*



TeraGrid
 New User Training

- TeraGrid new user orientation: account management, resource access, file transfers, user support
- Presented quarterly in coordination with new allocations
- PowerPoint slides plus live demonstration of content
- ReadyTalk web-based desktop sharing; speakerphone for audio
- Recorded and synchronized for offline viewing
- Interaction via multiple chat rooms – individual help, group discussions
- Outcomes: positive feedback from attendees; increased usage on attendee TeraGrid accounts



Center for
 Computation & Technology
 Louisiana State University

- 15 training sessions per semester, 2 to 4 hours duration.
- Introduce faculty, students, staff and post-docs with strong programming background to HPC: MPI, OpenMP, compilers, profiling, debugging, optimization
- Attendance ranges up to 20 in person, up to 30 on the Access Grid and up to 10 on NCAST (browser solution) which has recording capabilities.
- Attendees are graduate students, faculty and research staff; a few undergraduate students.
- Hands on exercises held during the training: 3 sites (LSU, U New Orleans, Tulane U) have computational scientists who are always available; the other sites have no one specific to help.
- Interaction through live talk in person and over the AG and instant message on NCAST.



OU Supercomputing Center
 for Education & Research
 University of Oklahoma



- "Supercomputing in Plain English" workshops, designed for computing novices with strong science/engineering research
- 425 registrations: 65 local (63 OU, 2 from local company); 360 remote from 70 institutions in 28 US states plus PR, Mexico and Argentina, including 37 institutions in 13 EPSCoR jurisdictions; 11 government agencies in US, Mexico, Switzerland; 8 companies in US and India; 1 US NGO
- Access Grid, H.323, iLinc (proprietary), QuickTime, phone bridge, slides downloadable, recordings as streaming video
- Hands-on exercises offline only, not live
- Interaction via text only, because of echo cancellation



This material is based upon work supported by the National Science Foundation under Grant No. OCI-0636427, "CI-TEAM Demonstration: Cyberinfrastructure Education for Bioinformatics and Beyond."



National Center for
 Supercomputing Applications
 University of Illinois



- Introduction to CUDA on Lincoln
- Broadcast from NCSA to 40 participants at remote locations throughout the US
- Duration: approximately 3 hours
- Real-time demonstrations
- No hands-on exercises
- Elluminate
- Interaction via Voice Over Internet Protocol (VoIP) and synchronous chat
- Participants interacted among themselves via chat
- Usage of CUDA increased following the webinar, which was the ultimate goal of the training.
- 100% of evaluation respondents said they would be interested in attending future workshops and tutorials delivered in this webinar format.



Common Lessons Learned

Online participation is challenging, but the benefits outweigh the costs.

Use of several facilitators alleviates additional workload issues, particularly in managing online instructional activities and remote technology troubleshooting.

Interactivity is key, and is well worth the effort. Constantly encourage it.

Proper handling of echo cancellation hugely improves participant experience.

Hands-on exercises substantially improve learning, justifying a strong commitment from the instructors.

Online participation by diverse audiences engenders discussions that can be of instructional benefit to all participants.

Preparation is crucial:

- distribute materials in advance;
- provide a hybrid collection of multiple technologies to improve robustness;
- manage expectations by providing a clear description of what will be covered;
- manage remote use of technology by providing hardware requirements, setup and connection instructions in advance;
- practice and adapt presentation skills for the remote audience, to enhance the synchronous online learning experience (using video, talking, listening, using chat/IM as cues to body language).