

Collaborative Design and Education (CoDE) Environment at the iLab

MUITC – IIF 2010-2011

Final Project Report

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Proposal Summary

We proposed to create a state of the art learning and collaboration environment integrating a variety of commercially available hardware and software that are affordable and easy to use in an innovative way. The Collaborative Design and Education (CoDE) environment is intended as a facility for collaboration and innovative instructional practices involving digital media.

CoDE Technology Implementation



CoDE Environment showing the primary display achieved using the Dell projector (left) and the 60" DLP TV (center) as well as the 3D display (right).

In addition to our 18' by 6' rear-projected, stereoscopic display, we added a 12' by 8' whiteboard to facilitate collaboration. The whiteboard acts as the primary shared workspace for digitally mediated collaboration. We are using eBeam technology from Luidia Inc. for digitally capturing the interactions on the whiteboard whether using whiteboard markers or using stylus for projected content. In addition to capture technology, the collaboration software suites from Tidebreak™ – TeamSpot™ and ClassSpot™ form the heart of the CoDE environment. TeamSpot helps to dynamically and interactively control the connection of individual laptops to the collaborative digital work surface. It allows

movement of information and artifacts across devices to the shared work space or to other team members. This transfer of documents and drawings (irrespective of the file type or software origin) and web URLs is achieved through an intuitive drag and drop transfer. Individual users can also edit a file in the shared workspace. As part of our MUITC grant we purchased a Dell T3500 graphics workstation and two Dell M4500 mobile workstations¹. The Dell T3500 acts as the primary computer in the CoDE environment with the TeamSpot host software. The Dell S300W projector and the Mitsubishi 3D TV act as the primary collaborative workspace. Two new Dell M4500 mobile workstations along with two other graphics workstations from the iLab complete the CoDE computing infrastructure and act as the TeamSpot clients. Altogether, five computers currently form the CoDE environment and we are adding two more mobile workstations in Fall 2011. We dropped the video switcher from our implementation since we could achieve the same functionality using the TeamSpot software without additional expenses for the hardware. We had intended to use the video switcher to easily switch source of the display for the shared workspace from the different computers.

Usability Evaluation

We evaluated the usability of the CoDE environment informally during each stage of the implementation and more rigorously in the past few weeks with IRB approval. Three teams, each having three members, participated in the extensive formal evaluation. One of the teams was comprised of students who had collaborated on MU's last entry for the Solar Decathlon competition. They were well aware of the challenges of design collaboration and co-ordination. Each team met over multiple, multi-hour sessions to work on a design problem. In addition to observation and analysis of each team's use of the CoDE environment, the team members completed a questionnaire evaluating the CoDE environment. The questionnaire included Likert type items evaluating the quality of the teamwork as well as the formal features of the CoDE environment. The team members also completed a detailed, open ended questionnaire assessing their overall experience, identifying appealing features; point out frustrations, their perceptions of the CoDE's impact on collaboration and suggestions for improvement. A small group of undergraduate students from Architectural Studies are currently forming a team to participate in the primary competition for the 2013 Solar Decathlon. Lead team members were part of our formal usability study and we plan to record the design collaboration sessions analyze the

¹ We had originally proposed 4 tablet PCs to be used as part of the CoDE environment. But the graphics capabilities of the tablet PCs were found inadequate for collaborative 3D modeling and hence we decided to purchase a graphic workstation and two mobile workstations instead of tablet PCs.

collaboration behavior using the INTERACT software. Key findings from the usability sessions are listed below:

Overall Experience:

- Positive, quick to learn the basics, allowed for easy brainstorming and team members emphasized the ease of use and the ease of co-ordination
- Made collaboration more streamlined, more co-ordinated and emphasis on communication among team mates than on file transfers via e-mail or flash drives.

Appealing Features:

- The large display of the shared workspace, the ability to show and share screens with other users and the ability to interact with another user's screen from own computer
- Ability of work on "chunks" of the larger design project individually and easily share the components to the shared workspace to assemble them
- Ability to take a "snapshot" and "record" key decisions and ideas as they happen during the collaboration process
- Ease of set-up and intuitive simplicity of the software involved
- Ease of file sharing and sharing individual displays to the group was mentioned as the most useful feature
- ability to "archive" sessions

Suggestions for Improvement:

- Need for more practice sessions and more training: Easy to learn, but need some getting used to—especially with the multiple mouse-ins on the shared display
- Initial learning curve noticed in group dynamics and communication while using the TeamSpot software
- Shadows cast by the front projection set-up using the projector for the shared workspace
- Suggestions from users for U-Shaped furniture arrangement to be more face-to-face with team members
- E-beam could only track one marker/ stylus at a time on the white board. Suggestion to use Wacom tablets as a peripheral for the graphics workstations so that other users can "sketch" at the same time

We noticed that the eBeam Whiteboard capture features were used more in the early stages of the design process as the medium was more conducive for abstract representations. As ideas took a more concrete form, team members switched to CAD software on individual computers and collaboration was primarily using TeamSpot. The eBeam features were also used to record important ideas and to keep track of project development. Overall, we found that the CoDE environment was successful in facilitating collaboration and students and colleagues see it as a valuable tool. We are working to improve the environment by taking into consideration the usability comments planning to actively integrate the CoDE environment into our courses and student led projects. Some key plans for future use are identified below.

Planned Use

- To be used by solar decathlon team developing designs for 2013 international competition. Two team members have received basic training and have helped in the usability evaluation.
- Since technology is portable, three of the co-investigators plan to use it on an experimental basis for 2 undergraduate courses in Architectural Studies for enhancing the collaborative learning experience
 - Design Communication
 - Studio V
- Planned to be used for collaborative projects in design studio and to be used for design reviews.
- Jenna Kammer, the academic technology liaison for the College of Human Environmental Sciences has been part of the implementation team and is knowledgeable about using the CoDE environment. She will act as a link to ET@MO and other units within HES who wish to use the facility.

Expense Report

A detailed report of the expenses associated with the implementation of the CoDE infrastructure is included at the end of this document.

**Information Technology Fee
Innovations Grant Award Summary for**

HARDWARE EXPENSES			
Description	Location	Qty	Cost
Dell Precision T3500 Graphics Workstation	233 Stanley Hall (iLab)	1	2,366.84
Dell Precision M4500 Laptops	233 Stanley Hall (iLab)	2	3,680.62
Luidia E-Beam Edge Complete Bluetooth	233 Stanley Hall (iLab)	1	1,224.95
eBeam Livewire Software Dongle	233 Stanley Hall (iLab)	1	99.95
Dell S300W Projector	233 Stanley Hall (iLab)	1	982.20
Projector Replacement Lamp for Dell S300W	233 Stanley Hall (iLab)	1	134.24
Mitsubishi 60" DLP HDTV	233 Stanley Hall (iLab)	1	699.00
Total Hardware Expense			9,187.80

DEPRECIATION CYCLE: _____

SOFTWARE EXPENSES		
Description	Location	Cost
INTERACT Video Analysis Software	233 Stanley Hall (iLab)	7,388.00
ClassSpot-TeamSpot software bundle	233 Stanley Hall (iLab)	5,500.00
Adobe Creative Suite Licenses	233 Stanley Hall (iLab)	751.00
Total Software Expense		13,639.00

MISCELLANEOUS (Subscriptions, Training, Dues, Event Expenses, Etc)			
Description	Location	Qty	Cost
25' CAT5e Network Cables	233 Stanley Hall (iLab)	3	19.86
Total Miscellaneous Expense			19.86

FUND SUMMARY	
Grant Award	25,000.00
Total Expenses	22,846.66
Ending Balance	2,153.34