Collaboratively Evaluating and Deploying Smart Technology in Classrooms

Involving end users in classroom technology design allows pedagogy to drive technology

By **Bart Strong** and **David Kidney**

For several years prior to 2000, students and faculty at McMaster University rated classrooms below those at peer universities. In the case of many classrooms, the teaching environments were outdated and the technology was old. The provost determined in 2000 that we needed to make a long-term investment in our learning spaces. For sound pedagogical reasons we needed to renovate and equip our classrooms with the latest teaching technologies. We were not going to equip our rooms with expensive, cutting-edge technology just for the sake of using the technology.

To accomplish this goal, we set up a pedagogical, needs-based approach to evaluating, designing, and deploying new technology in renovated classrooms at McMaster. We applied academic criteria to the development of smart classrooms that meet the needs of faculty and students, resulting in a smart, customized podium, designed in complete consultation with faculty over a two-year period. The process included consultation, satisfaction/needs surveys, prototype development, and user evaluations prior to final deployment.

The provost and an ad hoc advisory committee on learning technologies established needs that led to creation of the Learning Technologies Resource Centre (LTRC), which was established in 2000. Space allocated in an existing library was renovated with grant funding from the Royal Bank, and administrative staff were hired or transferred from existing units by the end of 2001. The creation of this body began the process of updating classroom technology on campus. The LTRC has administrative ties to the existing Centre for Leadership in Learning, under the auspices of the academic provost.

The LTRC was given a mandate to administer all course management systems on campus, help faculty develop effective teaching tools, research and evaluate new teaching/learning technology, and manage all classroom technology in registrar-controlled rooms. In addition, an existing Classroom Audio-Visual Services Department was realigned from the administrative stream to the academic stream as part of the LTRC initiative. The provost established an Academic Computing Advisory Committee consisting of academic representatives from each faculty in the university, as recommended by a report on academic computing at McMaster written by the special advisor to the provost. The committee was charged to advise the LTRC on large projects and to liaise with their respective faculties. Subcommittees and other ad hoc advisory groups dealing with academic infrastructure (such as classroom renewal committees) were also set up with strong faculty representation. This structure was put into place to ensure that pedagogy would be the horse pulling the technology cart.

Starting with a Long-Term Plan

In November 2002 the LTRC developed a long-term classroom technology plan with input from the Academic Computing Advisory Committee, faculty technology users, registrar's office, and physical plant. This plan, while still in the final approval stages (some parts have been implemented, while others await funding), proposes standards for classrooms and estimates costs associated with long-term support staff and with renovating existing rooms to include appropriate technology. Design standards were based in part on the existing literature[1] and on a document from the Ontario Universities Educational Technology Directors Association (OUETDA). OUETDA is an organization of directors and managers of audiovisual and educational technology departments from nearly all the universities in the province of Ontario. Three member universities formed a working group and compiled a document titled *Guidelines & Specifica-*

tions For New Classroom Construction or Renovation[2] that recommends a set of classroom standards for Ontario universities. This document, amended and approved by the OUETDA membership, formed the foundation for the proposed McMaster Classroom Standards Plan.

Although all of the literature was important in achieving a level of standardization in classrooms, the most important aspect of the process was the collaborative and consultative model that McMaster used to achieve its "pedagogy driving technology" objective.

Evaluating and Deploying the Technology

The need to improve classrooms and enhance learning technology had already been established through faculty satisfaction/needs surveys and student feedback conducted every two years. One of the most important implications in the long-term plan was the development of technology standards for high-end lecture theaters and auditoria. The process of determining these standards began with a grant proposal to evaluate and build classroom podiums that would allow faculty to control the learning environment from a central location and incorporate the most advanced learning technology available. The Universities Future Fund awarded a $100,000 (Canadian) grant to build three prototype podiums with integrated computers, data projectors, and touch-screen control panels. The grant also had to cover all classroom installation costs.

We studied various podium designs and made several field trips to other institutions, including the University of Ottawa, that already had similar installations. The lessons we learned from other institutions were incorporated into the design of the McMaster model. After consultation among our Classroom Services staff, the Centre for Leadership in Learning, the LTRC, and several faculty users, we engaged a carpenter to build the first prototype (Mark I), which was installed temporarily in the Preview Room of the Classroom Audio Visual Department.

The computer used in the installation, a fairly standard Dell Pentium 3 desktop system with Windows XP and Microsoft Office installed, was selected based on input from the academic director of the Centre for Leadership in Learning. We attached a basic Crestron control unit, which can serve a variety of functions, for example as a control panel to operate all hardware in the room (turning on and off the VCRs, computers, and projectors, and even controlling the screen and lights in the room). Finally, a telephone and set of light switches were added to simulate the proposed look of the box.

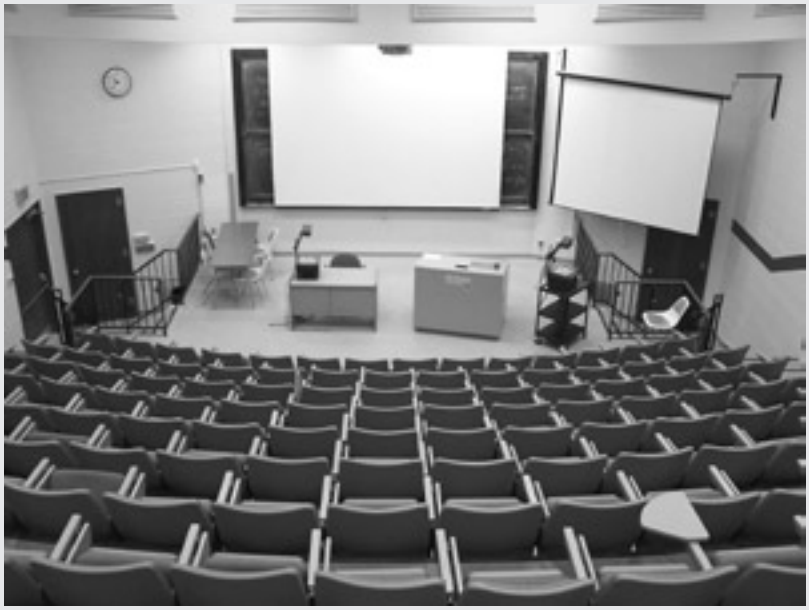
We invited 30 faculty members to test the technology in the simulated classroom and fill out a questionnaire regarding the design and usefulness of the technology. The faculty members chosen represented a broad range of potential users. One, for instance, was looking for full-service, total-control data projection. Another used only overhead transparencies in his teaching and was excited by the prospect of using computer projection to display his notes in MS Word. A summary of faculty evaluations and copies of all survey forms can be found at <http://www.ltrc.mcmaster.ca/strongb/>.

We then had a fully functional podium built, incorporating the changes suggested in the evaluation. This upgraded (Mark II) podium was deployed in the LTRC for further testing, and a second Mark II podium was installed in a new engineering lecture theater. These second-generation prototypes featured scaled-down footprints (to reduce size), a slight tilt in the top (for easier viewing of the monitor), and an upgraded Crestron control pad placed on a newly angled front piece for accessibility by physically challenged users to more easily reach the controls.

A second round of evaluations with the same faculty group proved that we were on track with the design and that all that remained were a few enhancements to the technology. For example, some faculty members still expressed concerns about ease of use and accessibility. We incorporated the recommendations gathered from this round of evaluations into the third working model (Mark III), which was then installed in a renovated science building lecture theater (see Figure 1) and equipped with the latest in network

Figure 1

Mark III in Lecture Hall



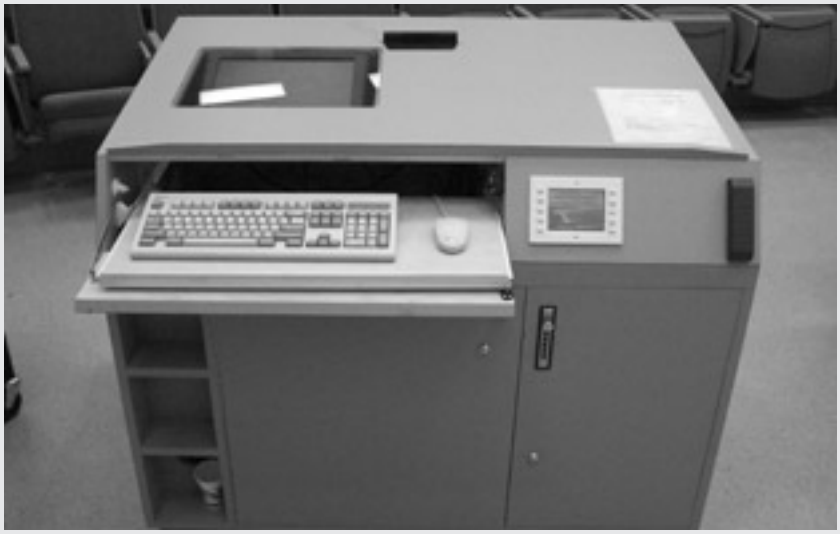
data projection, DVD/VCR, onboard computer with Ethernet, LCD Crestron control with full-color preview, enhanced security card access, desktop microphone, and inputs for client laptops (see Figure 2). This classroom was located directly across the hall from the Classroom Audio Visual Department, which enabled us to provide quick support in case of difficulties.

After the first few days of operation, it was clear that instructors felt uncomfortable with the voice lift provided by the desktop microphone, which they perceived as not being sensitive enough. Although tests showed the microphone worked well, we wanted to make people feel comfortable and confident with the system, so we installed a wireless microphone after the first class. When we discovered that some users wanted to run small PowerPoint presentations without depending on their own laptops, we installed a USB extension to accommodate Flash memory cards. One lecturer asked if it were possible to run his slide show from his Palm Pilot. After a week or two of research, we discovered that with the use of a Margi card to connect the Palm system and the on-board computer, this was indeed possible. Without end users' asking these questions, we might not have investigated some of this technology for quite some time.

Our technical supervisor was given the job of coordinating with contractors, running cable, installing the projector on the ceiling, and managing associated issues of infrastructure. A second staff member was assigned to organize the assembling of the computer and control functions of the podium. He also attended Crestron programming level 1 training and headed the security function and faculty training. This second staff member organized training sessions by first contacting the registrar for a list of all faculty members who would be using the classroom. Each instructor was then contacted by e-mail and by phone to set up a meeting for training. Instructors who did not attend the training session were not allowed access to the equipment, due to the security requirements.

Figure 2

Mark III Smart Podium



The podium is accessible only by security cards that receive time-limited access codes. The passwords also change each term. The training caused some problems because a few faculty members refused to be trained or to trade in their old-style ID cards for the new magnetic cards. When it became clear, however, that the human resources department was driving the change to magnetic cards and that there would be no access to the equipment without the training, everyone acquiesced. As a result, we had consistency in the way each user was trained on the application of all devices attached to the podium.

The cost to fully install the multimedia component in this lecture theater was $33,000. It will now become the model for all future deployments of smart technology in lecture theaters on campus and has been extremely well received by faculty and students.

Addressing Usability and the User Experience

In his book *The Human Factor: Revolutionizing the Way People Live with Technology*, Kim Vicente wrote eloquently of the need for intuitive front doors to technology, which was a huge challenge with our project:

> More and more, we're being asked to live with technology that is technically reliable, because it was created to fit our knowledge of the physical world, but that is so complex or so counterintuitive that it's actually unusable by most human beings.[3]

In no way did we want our design to be counterintuitive or unusable. Again and again as we worked toward completion, and right through to the early days of classroom use, we repeated the mantra, "Make it as intuitive as possible." Where absolute simplicity was not possible, we created "intuitive" descriptions to "explain" the inexplicable. For instance, the security cards must be swiped twice to grant access, though no one could tell us why. When faculty members asked, all we could say was, "That's just the way it is!" After reading Vicente, we invented the following response: "The first swipe tells the system that you are logging on; the second swipe turns the system on." People responded with a knowing "Aaah!" and thereafter remembered to swipe twice.

Daniel Niemeyer similarly stressed simplicity in design for smart technology in his book *Hard Facts on Smart Classroom Design: Ideas, Guidelines, and Layout*:

> Make classroom technology as simple, friendly, and non-intimidating as possible. Technology should

inspire presenters who rely on improvisation, spontaneity, and audience participation. The addition of computers should not make simple A/V devices like overhead transparencies, slides, and television more difficult to use. A simple lectern with PLUG & SHOW capability permits the presenter to display laptop computer output on a large screen. Complex installations tend to be awkward, expensive to change, and require continuous upgrading.[4]

Whereas Niemeyer recommended the "plug and show" model (a simple lectern), our design encompasses a much larger vision—which he did discuss later in his book—but maintains the simplicity and "non-intimidation" that is his (and our) end goal.

We recently participated in a technology symposium organized by the Centre for Leadership in Learning. Although we spoke for only one half-hour of a two-day event, we requested that our presentation take place in the Mark III model classroom to demonstrate the flexibility and simplicity of this new technology. The presentation was broken down into three parts: a history of the unit, the technology involved, and a demonstration of how the podium is used in an economics class. Attendees expressed a great deal of interest in the podium and its design and use. One of the attendees, Christian Blanchette, is the director of a similar Centre for Technology and Education from the University of Ottawa. The University of Ottawa is where we went to start the process, and now the collaborative circle was complete. The director expressed admiration of our adaptations to their original design and took ideas learned from our installation back to his institution, particularly the smaller size and accessibility options. In an e-mail to us after the conference, Blanchette noted,

> I have to say the smart room you demonstrated … is very good [and] has sparked interest back at the University of Ottawa.… As I described to you, our experience with close to 90 of these rooms has shown us that the only feasible way to minimize down time in class has been to act on two fronts: simplification of the technology and fast response to technical problems. The podium and your choice of control panel give you simplification. The support at a distance capability of your technology is sure to minimize down time.… You also are ahead of the game on accessibility of the podium. We will look at your podium redesign to see if it can provide us with solutions to this thorny issue. The restrictions given by the Ontario Accessibility Law are strict, and you are one of the first to solve it elegantly.

Concurrent projects throughout the university focus on collaboration, cooperation, and consultation.

Observations and Conclusions

Overhead projectors are still permanent fixtures in every classroom on campus and will probably remain so for many years due to ease of use, cost, and the fact that many lecturers already own transparencies of their material. Faculty members are becoming increasingly comfortable, however, with data projectors, electronic presentations, and online data retrieval. Smart classroom technology at McMaster, especially in this lecture hall, has been extremely well received by users simply because of the collaboration and planning that went into designing and implementing the technology. As long as faculty and student needs are met in the classroom in a cost-effective and collaborative way, every stakeholder—including students, faculty, support staff, and administrators—as well as the reputation of the institution itself will benefit.

The McMaster model is not simply a design plan for a specific podium, nor is it merely a pattern for deployment. It is a model for cultural change. McMaster's administration is committed to a campus-wide cultural change—to develop and engage its staff members and to work together with faculty and students at all levels. Concurrent projects throughout the university focus on collaboration, cooperation, and consultation. In the podium development project, we expanded the field to include other universities in the province, and, through regular meetings with OUETDA, we were able to share information and resources in a way that eventually circled back to benefit the originating university. *e*

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Endnotes

1. D. Niemeyer, *Hard Facts on Smart Classroom Design: Ideas, Guidelines, and Layout* (Lanham, Md.: Scarecrow Press, 2003); and R. L. Allen et al., *Classroom Design Manual*, 3rd edition (College Park, Md.: University of Maryland, 1996).
2. Ontario University Education Technology Directors Association, *Guidelines & Specifications For New Classroom Construction or Renovation*, 2002, <http://www.ltrc.mcmaster.ca/strongb/QOUETD Classroom Standards.doc>.
3. K. Vicente, *The Human Factor: Revolutionizing the Way People Live with Technology* (Knopf Canada, 2003), p. 17.
4. Niemeyer, op. cit., p. 6.

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