

A Variety of Diversity: Facing Higher Education's Educational Challenges

Eric L. Dey

*Center for the Study of Higher and Postsecondary Education, University of Michigan School of Education
610 E. University, Room 2117D SEB, Ann Arbor, MI 48109-1259*

Abstract. First among the many important challenges facing American higher education is the need to improve the effectiveness of our educational programs. Public concern has heightened the sense of urgency for colleges and universities to make progress on improving and measuring educational outcomes, which is made more challenging by the varieties of diversity facing us. Diversity is not just an issue related to student recruitment or experience, but rather it is one that also relates to institutions and their faculties. New educational methods must address such diversity to be effective, and one possible example can be found in ongoing research at the University of Michigan that explores the educational implications of implementing a web-based lecture capture system in large lecture courses. Student use of and reactions to such systems is important, as is the potential to influence course performance for students in general, but also for underrepresented and at-risk student subpopulations. In addition to helping bring our current landscape into focus, this paper will identify effective practices as well as continuing challenges to improving educational practice for undergraduate students.

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INTRODUCTION

Due to high profile legal cases and heated debates centered on affirmative action issues, it is common to see diversity primarily as an issue relating to student characteristics and experiences. While student issues are certainly critical ones from a diversity perspective [1], it is truly the case that there are a variety of important diversities within higher education. As a system, the American higher education enterprise is comprised of an extraordinarily diverse set of institutions with very different goals. In fact, the institutional diversity is such that education is perhaps the one common goal across the system (as opposed to research and service goals), and also the one in most need of research and improvement [2].

In this paper I explore issues of diversity and their educational consequences, opportunities associated with the deployment of lecture archiving technologies to address some of these issues, and finally consider the role of research in promoting educational reform and improvement.

THE MANY FORMS OF DIVERSITY

American higher education is in a profound state of change related to increased diversity in terms of

students, faculty, and institutions. Sharp (but insufficient) increases in student diversity are perhaps the most obvious, with broad implications for student learning and educational programs [3,4]. Faculty diversity is increasing more slowly than among student populations, due to a different set of organizational and systemic challenges [5]. The explosion of institutional diversity is underscored by the ever expanding classification system published by the Carnegie Foundation for the Advancement of Teaching, which has grown from a small taxonomy to one that incorporates multiple schemes (some voluntary on the part of institutions) for trying to define the range of institutions [6]. These dynamics fuel changes in the nature of experiences students have within colleges that most believe have not sufficiently developed new educational approaches to address these realities.

TECHNOLOGICAL OPPORTUNITIES

Technologies expand instructional options for faculty, and provide opportunities to serve changing student needs. Faculty resistance can impede the adoption of instructional technologies, making it important to create approaches that minimize the

burden on potential users of such technologies. One system that is intended to satisfy these demands is a lecture capture system that creates web-based archives of faculty instruction that have been piloted as the University of Michigan MScribe Project. The effort involved the development and deployment of advanced technologies as well as the implementation of an educational research component to study its effects on student learning.

The MScribe Project

The original pilot effort associated with the MScribe Project began in January 2006, and sought to develop, deploy, and evaluate a robust system for the automated web archiving of classroom lectures in a set of University of Michigan classes [7]. As described in our final report on the pilot from which the majority of this programmatic description is drawn [8], the ability to deploy an automated system for capturing classroom lectures for distribution via the web was based primarily on the experience and technologies associated with the Web Lecture Archive Project (WLAP; <http://www.wlap.org>).

WLAP is a joint venture between the UM-ATLAS Collaboratory Project, the University of Michigan Media Union, and the European Laboratory for Particle Physics and the European Organization for Nuclear Research (CERN), which has a goal of implementing an electronic archival system for slide-based presentations on the Internet. WLAP has recorded over 700 content-rich lectures and published them via servers at the University of Michigan and at CERN. This archive comprises a variety of lecture types, including general interest, class instruction, historical events and specialized hands-on software tutorials. It has monitored recorded lecture use patterns and has continued to improve capture and publishing techniques based on user feedback. The utility of such archives as a training vehicle for high level software developers has been firmly established by this group. Further work has been funded by the National Science Foundation to study the issues involved with the recording of lectures in environments where multiple sessions must be recorded simultaneously.

The impact on student learning and attitudes of advanced information technology usage in college instruction is still a matter that requires substantial study, preferably in existing educational settings with a level of support that is realistic in terms of its long-term sustainability. By piloting and evaluating a testbed system for capturing lectures, MScribe sought to not only ensure the robustness of the technologies, but also provide a natural experiment to test the effects of a technological innovation related to teaching and

learning-related activities. Researchers from the UM School of Education and the campus teaching and learning center worked with participating faculty to study and evaluate their use of the technologies and the resulting student learning. In collecting data from faculty and students involved in this pilot we were able to evaluate the activities from a programmatic perspective, while also providing some infrastructure and data useful to the University's campus assessment efforts.

MScribe Technologies

Four self-contained, portable, automated carts were assembled by the MScribe technical team and wheeled around campus to record all sessions of eight University courses during the academic year 2006-2007. Each cart was outfitted with audio/video equipment, video tracking system and a high-powered PC to record the various media feeds and control the tracking cameras, capturing audio, video, periodic still images of multiple chalkboards, and the VGA signal sent to the room's LCD projector.

Figure 1 shows aspects of one of the four MSCRIBE recording carts built for the pilot project. Mounted on top of the cart is a metal structure holding the tracking system, beneath it are keyboard and monitor so the operator can confirm the system is working properly, and underneath is the controlling computer system and assorted audio/video equipment. The entire system is controlled by START and STOP buttons, allowing unskilled operators to record 200 hours of video in the pilot courses.



FIGURE 1. MScribe recording cart and camera stalk.

The metal housing on top of the cart houses three cameras; the bottom camera scans for a special infrared necklace worn by the instructor, the top camera provides color video footage based on this tracking information, and the middle camera sweeps the room every 15 seconds taking snapshots of chalkboards.

After each recording, the carts were connected to the internet and the recorded media was automatically uploaded to our archival server. Dedicated media

processing servers then retrieved the media and created “Lecture Objects,” an archival form, which was put into the Lecture Object archive for long term storage. Then RealPlayer-based Web Lectures and QuickTime video podcasts were created and uploaded to web servers. Most of this post-processing is automated, thus requiring a minimum of human intervention.

The Educational Consequences of Deploying MScribe

Building on earlier educational research documenting the learning outcomes associated with the creation of web-based lecture objects that incorporate video of the presenter [9] students enrolled in the MScribe pilot courses completed surveys to capture their experiences and perceptions, which was supplemented with student and faculty interviews, data gathered from computer access logs, as well as academic performance information.

The student interviews and survey results revealed a number of insights into the successes associated with the current implementation of the technology innovation [10]. In general, students had a positive experience using the system. This positive experience is based primarily on students’ ability to view the lectures as many times as they choose. Being able to access lectures at any time allowed students more time to focus on important concepts presented during class. There is always the possibility that apparent effects of educational innovations receive a temporary benefit from the perceived novelty of the approach, especially when dealing with new technologies. In the current case, the participating students’ reactions appear to be based on utility considerations rather than the novelty of the technology.

As illustrated in Table 1, the students utilized the system in multiple ways. It particularly served as an effective learning tool as a study supplement and to “fill in the gaps” of students’ lecture notes. Students also used the system solely as an exam study tool and as a reference tool when working on weekly class assignments.

Interestingly, only 14.5% of students surveyed used the material as a replacement of the lecture; faculty did not report a noticeable drop in lecture attendance. Students also expressed an affective benefit to the system. Even though they did not attend class less than they otherwise would, they felt more confident in their ability to “play catch-up” when they did miss a class. Knowing that they could watch the lecture recording removed some anxiety (and, in fact, consequences) from their absence.

TABLE 1. Student use of web-lectures (MScribe survey)

Type of system use	Percent
Study supplement	40.2
Replace lecture	29.8
Exam study tool	21.8
Fill in “Note gaps”	26.3
Study group resource	2.5
Do homework assignments	12.3

All of the students surveyed noted that having this material available as a resource improved some of their class related behaviors (as shown in Table 2). These improvements usually occurred outside of the classroom. Some students mentioned that the system allowed them to listen and pay close attention to the lecture while they were in the live class, since there was less pressure to take meticulous notes at the live lecture. Instead, they used the lecture to take important notes and to “absorb” the information, then revisited the lectures via the web and built a more extensive set of notes. Other students mentioned that they used the system to revisit only certain parts of the lecture that they felt needed clarification. Additional analysis is underway to examine the effects of MScribe usage on student performance as measured by course grades, as well as an expansion of the work to include detailed information on MScribe usage derived from access logs in addition to student self-reports.

TABLE 2. MScribe impact on student learning behaviors

Behavior	Increase	Same	Decrease
Preparing for class	24%	75%	1%
Attending lecture	12%	70%	18%
Taking notes	17%	72%	10%
Reviewing notes	54%	43%	3%
Studying for exams	58%	41%	1%

The Role and Structure Of Research In Educational Practice Decisions

Given the challenges posed by the changing context within which the higher education enterprise operates the need for research-based guidance is increasingly evident. Within the larger field of higher education research there have been continuing concerns about “trees without fruit,” or programs of research not productively yielding results of use in improving practice [11]. At the same time, there have been very productive research efforts bubbling up from disciplinary efforts (including especially physics education research) that are rooted in local practice concerns which can be quite diverse, given differences in students, faculty, and institutional characteristics.

Given the challenges associated with both ends of this spectrum – large-scale, generalizable work disconnected from practice concerns versus focused,

localized work isolated from other efforts – it would seem that considerable progress could be made by forging new partnerships connecting both end points. Collaborative efforts across and within both disciplines and institutions are an important first step, and the work of the physics education research community can serve as an exemplar in this regard. Growing a collaboration open to new and different ideas for improving educational practice while remaining concerned with the use of research to inform future development would provide an ideal platform for making wise choices in this time of change.

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