

Implementing a Large On-Campus ALN: Faculty Perspective

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ABSTRACT

This case study describes the implementation and continued operation of a large on-campus ALN for a 500-student course in introductory physics. The ALN was used to modify and complement the original course and thus represents an evolution rather than a revolution. Factors that increased satisfaction and instances of dissatisfactions are presented. The potential increase in the latter with technology is of some concern.

KEY WORDS

ALN for traditional lecture classes, computerized individualized homework and examinations, *CAPA*

I. INTRODUCTION

Approximately 500 science and engineering students enter the calculus-based introductory physics two-semester course, PHY183-184, a requirement each semester. This course is part of the established curriculum, and its goals and standards are well defined by the textbooks commonly used across various institutions. In its present form, it is an attempt to combine the best features of the face-to-face interactions and lectures with the use of network tools for anytime/anywhere interaction. The goal was to establish and maintain high standards while providing students with means and opportunity to succeed. This ALN was initiated in fall 1995 and has been continued since that time [1].

II. RATIONALE

In Fall 1995, we implemented our first ALN with support of the Sloan Foundation. This was in large part as a consequence of discussion with colleagues at UIUC who had embraced the idea and already had encouraging initial results [2]. It also followed our successful use of computerized assignments in introductory physics and chemistry courses during the previous three years, which showed the added dimension networked technology could add to a course. The prospect of improved student performance and satisfaction was also a driving factor, especially as we had observed that students were spending considerably more time in the course: for the first time we were seeing student effort at a level that justified our own instructing efforts. This was indeed a source of satisfaction!

Other members of the department taught this course the past two years (Table 1). While using the ALN was not required, they were encouraged to do so to take advantage of the savings, which were generated by the reduced teaching staff used in the ALN, i.e., about 2/3 that used in the traditional course. The comments of these instructors are included in this case study.

Table 1: Information about the four faculty members of this study

ID	Rank	Years Teaching	Teaching Awards	IT Technology Experience
EK	Prof.	40	Yes	Yes
MT	Prof.	8	Yes	Yes
WL	Prof.	14	No	Some
BP	Prof.	22	No	Some

A. Background Information for the Course

This course was the first to use essentially all the features of an on-campus ALN. Being a required course for a large number of students, planned and actual enrollment was the same, 480 students.

A coordinator provided the technological support for the 15-20 instructors using the *CAPA* system each semester at MSU. This includes obtaining class lists electronically and providing them to the instructor in the proper format for immediate use, setting up the class directories, and testing that the system was operational for student login via Web and/or Telnet. The coordinator also set up the internet discussion forum for students, initially with commercial software and later as part of *CAPA*, and assisted in responding to students who encountered difficulties related to the technology.

Instructor training was a key part of the technological support. At MSU, supported by our Sloan Foundation Grant, we have opted for one-on-one training and it has worked very well so far. The coordinator introduces the instructor to the system and works with the instructor on the technical aspects of content preparation and on operation. The learning curve is thus very steep and defacto adapted to the instructor's technological skill levels. Time to become proficient enough to run a course has varied from less than three hours to three days. For most of that time, however, the instructor and coordinator are working on their own in the same office, with any difficulty encountered being addressed immediately. While this may appear to be less efficient than training in a class or workshop, our success rate is total; and once proficient, most instructors continue to use the technology.

Note that EK and MT are part of the development team of *CAPA* as ALN-tool. They had relatively small technology support requirements for ongoing course tasks, but had support in testing and implementing new or upgraded features.

B. Technology and Infrastructure

The principal ALN tool used was *CAPA*, a computer system developed at MSU over the past seven years, to implement a Computer-Assisted Personalized Approach in education. In the initial experience with its use, a 90-student science class, student reaction was very positive and has since been replicated in numerous other disciplines and at other institutions [3-9]. This integrated software system has been used (1) to prepare, deliver, and grade personalized homework, quizzes and examinations, (2) to provide feedback to students and instructors, (3) to communicate with students in a class and provide a discussion forum for students, (4) to provide links for student help via the Internet, and (5) for course management.

One issue in implementing the technology for large on-campus ALN course involves the printing of personalized assignments. Since the assigned work is on the Web, should students be given printed copies? Our reason for printing and handing out assignments has been to promote an environment where students collaborate and discuss their work, as such collaboration has been shown to have positive impact on performance [10]. Would such collaborations be less likely if they had to work at individual computers? We have recently collected some data on the printing issue. This past Fall (1998), assignments in a large student course (not using *CAPA*) were not printed but were provided on the web. When polled, most students said they printed assignments from the Web either all the time or most of the time.

We then polled the students in PHY183 (480 students using *CAPA*) during the fourth week of the semester to see if they would agree to have the following week's assignment not printed. The vote was overwhelmingly against, 420 to 6. In addition, 89 students commented by e-mail: one was willing and 88 were against. The reasons given in those 88 e-mails are shown in Table 2.

Table 2: E-mail responses of 88 students.

Why students want printed assignments	
Harder to work in front of screen	56%
Printed HW more accessible	43%
Trouble to print, quality of printing	27%
Web access required	18%
Work on-line too long	11%
Other reasons	18%

We believe that in our situation, the small effort by the instructor to prepare printed worksheets is well repaid by the large saving in student time and increased student interaction level.

C. Content delivery

Table 3 shows the various components of the course. As in most physics courses, demonstrations are a large component of lecture time. Traditional lecture time is however strongly reduced, allowing for large segments of time on interactive lecture exercises and unannounced short quizzes. These quizzes have a significant impact in improving class attendance even though they serve to assign only a very small proportion of the student's grade (5%). The quizzes are also useful in identifying misconceptions very early.

Table3: Time (%) spent on various aspects of the course

Activity	Before (%)	Current (%)
In Class Time:		
Lecturing	70	40
Quizzes	5	15
Exercises	5	25
Demonstrations	20	20
Recitation Time	100	0
Learning Center (Face-to-face)	0	100
Discussion Forum	0	100
Feedback	20	80
Exam Corrections/Feedback	0	100

Homework assignments are personalized. The conceptual problems are designed to encourage collaboration among students as they can benefit from the additional practice of working on somewhat differing versions of the same problems. Numerical story problems have variables which inhibit rote copying among students, and recently we have added new techniques that have strongly inhibited the sharing of formulas where one can just plug in one's variables and get the correct answer without really understanding the problems. Each weekly assignment had a firm due date, and this insured that students

did not fall behind. Students are given full credit if they get the correct answers before the due-date. If a solution entered is incorrect, the student may work to find the errors and has a number of tries allowed to get the solution. Thus most students are able to get very good grades on the assignments, and this has proved to be highly motivating. Note that these high grades do not lead to grade inflation as a higher absolute scale is used to assign the course grade.

Collaboration was also encouraged by a small component of teamwork in assignments. For example, a subjective essay discussing the observation of an experiment shown by video during class could be submitted by groups of five students working together but sending in a single submission. This also had a big efficiency factor for the instructor grading these essays.

Assignments had a significant component of challenging problems. Students could obtain help at anytime via the discussion forum established for the class. Posted questions were sure to be addressed within 24 hours or less. In addition, help was available at scheduled periods throughout the week in a Physics Learning Center. There teaching assistants, who were assigned to the class and who had themselves solved their own personalized assignments, used the Socratic Method in helping students with any difficulties. Students needing help could be there several hours while those who did not feel such a need were not required to be there at all. This face-to-face help was an important part of the class, and was helpful to the instructor as it provided complimentary feedback to the detailed on line feedback available from the student performance as recorded by the system. The Learning Center is also the way we have countered the impersonal nature of instruction in this large course. It provided many opportunities for one-on-one interactions between students and teaching staff.

A concept test given during the first week and again near the end of the class helped compare the class to others at similar institutions and represented one of the measures of learning. Mid-term and final exams were the main assessment tools. In the case of the midterms, we allowed students to earn “partial credit by corrections” for any part of the exams they had not done well. Following the proctored examinations, students could pick up a copy of a different version of the same exam. They then could solve the problems in that version within the next three days and enter answers via the internet. They could consult with fellow students, the teaching staff, etc. to get help. By this process, the mid-term grade was the original grade plus 30% of the difference between the corrections and original exams, i.e., they could recover 30-cents on-the-dollar of every missed point. Over 99% of students availed themselves of this correction opportunity, and it was a very popular option! For the instructor, it represented an effective and efficient way to encourage students to review the material of the exam and improve their understanding. A common comment by students finding out how to solve a problem they missed on the exam is “I should have got it! It really wasn’t that hard”.

III. RESULTS

A. Effectiveness

Before we discuss faculty satisfaction, we need to mention briefly the effectiveness results obtained from our ON-Campus ALN approach. These can be found in the Journal of Engineering Education [1], where we demonstrated a strong positive impact on student success in large classes while maintaining high standards. In retrospect, the improvement in student achievement observed should not have been surprising, as our approach was to retain the best established practices of more traditional teaching and to use ALN to fix the weak areas where it clearly could have a major impact.

The important aspects of using the technology which appear to have a significant positive impact on student achievement include:

- Interaction between the students and the computer using materials and problems well adapted to the technology enables students to receive instant feedback [11,12] on their understanding of concepts and ability to carry out calculations properly and also get access to specific help provided by an instructor or provided via links.
- Interaction between the instructor and the computer provides the instructor with on-line feedback on student misconceptions and misunderstanding so that they can be addressed in a timely manner, usually before the work is due. It provides early, comprehensive information about individual students who are having difficulties, information, which is essential to properly advise these students.
- Asynchronous interactions among students and between students and instructors via the network provide the opportunity for questions, answers, discussions, and elucidation of difficult concepts within the context of “anytime/anywhere”.

In addition, the efficiencies generated by the use of technologies allowed us to devote increased teaching staff time to Socratic one-on-one interactions with students.

B. Faculty Satisfaction

To put the faculty satisfaction issues in perspective, we have interviewed faculty including some who have not used ALN in their discipline and looked at previous studies of issues, which affect faculty satisfaction [13-18]. Clearly, faculty satisfaction is very complex. The principal factors which emerge from the literature, from interviews with our colleagues in this study and our own experience include collegiality, workload, and autonomy. One interesting observation is about role conflict, which occurs at the intersection between faculty and administrative domains of responsibility. While it does not affect general faculty satisfaction, it can be a source of disaffection and dissatisfaction.

Our experience has been that the implementation of ALN technology on a large scale in teaching has greatly increased the domain where administrative and academic responsibility and control meet. Thus it is not surprising that we have experienced numerous situations that engendered faculty dissatisfaction, ranging from not-so-important to critical factors in our perception of how our task should be carried out. In this area of collective decision-making and responsibility, we have encountered a spectrum of administrative attitudes across the administrative ladder at MSU. In the four situations briefly described below, we should keep in mind that the descriptions are from the faculty, and that the perception of the administrator(s) involved may be considerably at odds. The following paraphrase professors either using or using and developing ALN.

- Case A — While teaching a large (700 students) introductory physics course, I came across a software program which displayed physics demonstrations. This software was priced around \$150. I had already been displaying demonstrations on a screen and thought this software would fit nicely with the existing format of the class. In response to my e-mail requesting authorization to purchase that software, the department chair responded that I should e-mail the person in charge of the academic affairs committee, which I did. This person responded that I should first get a demonstration version of the program, which I did. I received the demonstration version of that program but that version was inadequate. By this time, it was near the end of the term. I was frustrated with the process and discontinued my attempt to incorporate this program into my class.
- Case B — In implementing the large ALN on campus, I decided there was need to provide students an opportunity for a face to face interaction and help with teaching staff above and beyond what that provided through the network. A learning center was established with furnishings consisting of tables and chairs and computers obtained from salvage. The computer needs in this spartan environment were quite modest, vt100 terminal emulation, as our ALN predated the use of the sophisticated web browsers ubiquitously in use today. As the use of the ALN concept spread to a greater number of

students, this initial setup soon became insufficient for the large demand and new capabilities. Requests that the area be upgraded and improved in several aspects eventually received administrative approval, at which time I informed my students to just bear with us for a bit as significant changes were soon forthcoming in improving that component of the learning environment. These changes were then canceled and not implemented until more than a year later. I felt angry and frustrated.

- Case C — Discussion with the dean and chair established the need for centralized support for faculty using the technology. The combination yearly of contributions from the two most highly involved departments and the college with miscellaneous funds (education research grant, etc) has provided a salary for a coordinator to support faculty across campus in the use of the *CAPA* as ALN tool. Administration has clearly expressed support of a more permanent arrangement, which would eliminate my task to see that the support for the position is there each year. In spite of the 6000+ students involved each semester, such an arrangement is still not in place 5 years after the position was first filled.
- Case D — When a key developer of the *CAPA* system left the university, I made repeated requests for support to continue development and essentially met no action, either positive or negative. I then addressed the request directly to the highest administrative level. This action triggered a significant dissatisfaction at lower administrative levels. Still the outcome was that the request was fulfilled, with the university continuing to support the system development.

The above are one-sided views in areas of shared responsibility, and could be described in quite different terms from an administrative perspective. In the implementation of ALN technology, such areas have grown significantly and thus increase potential conflicts as faculty and administrators carry out their tasks.

Administrators have an increased and important role, in an area where they have limited knowledge and in which faculty also are not often experts. A quote (with a large dose of sarcasm) from a colleague asked to comment on sources of dissatisfaction in his work, "... too much administrative interference, decisions based on ignorance."

We do not want to leave the impression that conflicts dominate our interaction with our administrators. On balance, they been facilitators and helped to establish the conditions in which we have obtained highly positive and encouraging results [1].

The level of satisfaction with the On-Campus ALN implementation is high across many disciplines and faculty who have implemented all or part of its functionality. This satisfaction comes in spite of the universal agreement among faculty that work is increased, especially initially. Technical support is rated good to "wonderful". Positive interactions with satisfied students, by far the majority, is a big factor, as is the interactions with colleagues doing ALN with whom one can share a remarkable variety of wonderful stories. The On-Campus aspect has strong appeal. One faculty who volunteered that he is now "... a convert to this technology" added that he liked that he was "still teaching the normal way." Another commented "This was the first time I had the ability to really see how students were doing in such a large course and could review that information before meeting with them."

There has been a redistribution of responsibility in the large courses. More of the course administration and management has become part of the lecturer's work. Instructors now have detailed knowledge of student performance, and so do the students. There is far greater interaction with students, via e-mail in particular, which is yet another factor increasing the time spent on a course. Those students who are having a difficult time, or who believe that getting some work excused is equivalent to having done the work take up a far greater proportion of the instructor's time, seeking assistance when it is clear that very little studying has occurred. This additional work is a for many faculty a source of dissatisfaction. Others who perceive the added work just are not interested adopting the new technology.

For faculty excited by the new opportunities, there have been many rewards. These include (i) increased collegiality with colleagues in other departments and disciplines, (ii) a perception that they can influence outcome, (iii) improved relations with students who are benefiting and who view the instructor as mentor rather than judge, and (iv) positive feedback from graduate assistants whose work has been moved from grading and record keeping to Socratic interactions with students.

IV. SUMMARY

We believe that at MSU, ALN can and soon will be a significant part of the educational experience for a majority of students. This will be helped considerably if, as the number and variety of more sophisticated technical tools become available, faculty are assisted in becoming skilled in their use and the increased work load is kept in check. Broad implementation will also be assisted if faculty and administrators develop means to deal with the increasing number of conflict situations where their functions overlap.

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