

# Distance Learning Via Lotus Notes Learning Space™ in a Nontraditional PharmD Program: A Preliminary Report<sup>1</sup>

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Preliminary experiences using Lotus Development Corporation's Learning Space™ computer database management program to provide distance learning courses in a postbaccalaureate Doctor of Pharmacy program are described. A dozen students who participated in at least one of five courses offered via Learning Space™ responded to an electronic survey regarding their experiences and attitudes towards this approach to course delivery. Despite many initial problems, students liked the time flexibility offered by the program, and perceived that their computer skills improved by using the program. Faculty reported spending approximately twice as many contact hours in the electronic courses than in the corresponding live classroom courses; however, faculty also reported that Learning Space™ offered specific advantages over teaching in a live classroom. The System Operator proved invaluable to the success of the electronic courses, and it is imperative to have this type of technical support available for such an undertaking.

## INTRODUCTION

A report from the American Association of Colleges of Pharmacy noted that 40 of the country's 79 pharmacy schools planned to offer nontraditional PharmD programs by Fall, 1998; twenty-eight of these programs anticipated utilizing distance education approaches in their nontraditional curricula(1). Schools and colleges of pharmacy have approached distance education through the use of conventional paper correspondence courses (references 2 and 3 are representative), audiotaped lectures(4,5), videotaped presentations(6,7), electronic mail(8), real-time compressed video(7,9), real-time chatrooms(10), World Wide Web (WWW)-based courses(11), or combinations of these techniques. Albany College of Pharmacy has utilized the New Jersey Institute of Technology's Virtual Classroom™ and Wildcat!™ distance learning software for discussion sessions and group projects(5). The present paper reports on one of the first applications of Lotus Development Corporation's Learning Space™ computer program for providing distance learning courses in a post-baccalaureate Doctor of Pharmacy program.

Learning Space™ is based upon Lotus Development Corporation's Lotus Notes™, a computer database management program designed for use predominantly by private corporations. Lotus Notes™ enables geographically-distant members of a project team to asynchronously contribute their efforts to a group work assignment. That is, Lotus Notes™ enables team members, at their convenience, to download a project, make revisions, and upload the revised project for the next team member to download and revise as each team member's schedule allows.

Neither Lotus Notes™ nor Learning Space™ have been used to any great extent by academic institutions. A computer search of the ERIC database yielded only one description of the use of Learning Space™(12); no pedagogical evaluations of either the Lotus Notes™ or Learning Space™ programs were identified.

Utilizing Learning Space™ to provide didactic instruction, The University of Montana-Missoula (UM) launched a nontraditional PharmD program in the fall of 1997. Baccalaureate-trained Montana pharmacists and out-of-state UM pharmacy graduates are able to pursue PharmD training while continuing their present employment. Nineteen pharmacists from three states, enrolled in UM's first nontraditional PharmD class, have completed Learning Space™-based courses at the time of this report.

## Pedagogical Considerations

Learning Space™ balances the interactive capabilities of synchronous distance learning with the time flexibility characteristic of asynchronous instructional approaches. With asynchronous audiotaped or videotaped lectures, or with conventional correspondence courses, much student learning occurs in isolation. Students in a Learning Space™ course, however, interact with instructors and classmates via electronic mail. Real-time communications are not possible with Learning Space™ as with chatrooms or two-way compressed video; the trade-up is that students need not be on-line or present at video receiving sites at the same time to participate in a discussion as they would with live chatrooms or synchronous compressed video.

Asynchronous Learning Space™ enables students separated by hundreds of miles and in different time zones to participate together in group projects or discussions while accommodating their own work/life schedules. At any time students can download an assignment from the campus-based server, access the Internet to obtain additional references, and e-mail questions about the assignment to the instructor without leaving the Learning Space™ environment. Similarly, if the assignment is a group project, students can contact their class-

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mates and upload the newly revised assignment to the server for the next student's revisions without leaving the program. Instructors, as their own schedules allow, use Learning Space™ to monitor student participation throughout the learning process. Assignments can also be downloaded for review and grading more quickly and reliably than via surface mail.

### Course Development

The University's Center for Continuing Education purchased the Learning Space™ software and a dedicated server, and provided training for those pharmacy faculty who would be teaching Learning Space™-based courses in the near future. The first course to be adapted to Learning Space™ was Drug Literature Evaluation, a three-credit, semester-long course. The primary instructor required the better part of an entire summer (approximately 30 hours/week for 10 weeks) to adapt existing course materials, many of which were already in electronic word processor or presentation package formats, to Learning Space™. A module introducing students to drug literature searches via the Internet also had to be developed using ScreenCam®(13) before being incorporated into the Learning Space™ program. Much of the time spent preparing this initial course was attributable to the fairly steep learning curve found to exist with Learning Space™, even among faculty who possessed proficient computer skills. Faculty also expended a great deal of time and effort incorporating as many Learning Space™ features as possible into this first course to provide students with maximum exposure to the program's capabilities. Other courses adapted to the Learning Space™ format were Therapeutics I and II, Case Studies I, and Pharmacoeconomics and Outcomes Research.

Faculty decided to activate only a few learning modules at a time within each course. This was intended to prevent the more proficient students from racing ahead of their classmates, so they would be available to participate in electronic class "discussions." Modules were posted to the campus-based server a few weeks before assignments in those modules were due; approximately every two weeks, another one or two modules would be posted to the server for students to access.

### Early Experiences

Pharmacist-students participating in the nontraditional PharmD program came to campus at the beginning of the term for a weekend-long orientation to the PharmD program; a substantial percentage of this time was devoted to providing the pharmacists with a hands-on introduction to the Learning Space™ program. Each pharmacist was required to have access to a computer in their home or workplace which could run the Learning Space™ software. Minimum computer specifications were a 486 processor operating at a speed of 66MHz, 16Mb of random access memory (RAM), 500Mb of free hard drive space, a modem, Internet access and either Microsoft's Windows 3.11 or Windows 95 operating systems. It was initially quite difficult to accommodate Apple Macintosh computer users as the "Mac" version of Learning Space™ was not available at the time.

Problems emerged immediately. Some students' computers, despite meeting or exceeding the minimum specifications, petulantly refused to run the Learning Space™ software, predominantly due to differing computer configurations. The time required to transmit Learning Space™ databases from and to the campus-based server was sometimes excessive, occasionally requiring several hours. Slow transmissions resulted from

the large sizes of some databases being downloaded from the campus server, slow modem speeds, insufficient memory in student computers, large numbers of simultaneous users, and/or problems with students' Internet Service Providers. Some transmittal times were so great that the campus-based server would repeatedly disconnect the student before transmission could be completed, forcing the student to start anew each time. During a campus-based construction project, workers accidentally severed the telephone line connecting the Learning Space™ server to the outside world, preventing students from accessing the server for several days.

In addition to the hardware problems outlined above, a few students were incapable of properly loading and operating Learning Space™ on their own, despite receiving several hours of on-campus training. Other students lacked the familiarity with their home computers necessary to perform minor troubleshooting (invariably late at night or during weekends) without assistance. These problems accumulated to the point that by mid-term the entire external PharmD program nearly ground to a halt when several students threatened to withdraw from the program due to the gravity and frequency of computer problems being encountered.

In response to the many crises that arose at the end of the first term in which Learning Space™ had been used, the System Operator (SysOp) in the University's Center for Continuing Education developed a World Wide Web (WWW) version of Learning Space™ using Lotus Development Corporation's Domino® software. This greatly simplified student operation of Learning Space™, eliminated virtually all of the computer hardware-related problems which had arisen, and enabled students using Macintosh computers to fully participate in the courses. Real-time chat rooms, a feature not available in the software version of Learning Space™, were also created. The SysOp also produced detailed user's instructions to accompany the WWW version of Learning Space™, as he had done previously for the software version of the program.

The WWW version of Learning Space™ did suffer from several drawbacks. Students had to remain on-line during their entire Learning Space™ session instead of simply downloading material and working on it locally. This became a very expensive proposition for students who paid for Internet access by the hour rather than paying a flat monthly fee for unlimited access. The WWW version also required students who wanted to complete course assignments at their workplace or those who were away from home for extended periods to always have Internet access available. The WWW version also cannot fully utilize all of the features available in Learning Space™, such as the self-assessment quizzes that provide immediate feedback and explanations when incorrect answers are selected. These deficiencies of the WWW version of Learning Space™ were noted in particular by those students who had not suffered any mishaps while operating the software version; these students subsequently expressed a preference for the software version over the WWW version. A final drawback of the WWW version is that faculty needed to revise some of the instructions in their existing Learning Space™ modules because navigation between Learning Space™ databases in the WWW version differs somewhat from the software version. Despite these drawbacks, the WWW version of Learning Space™ worked sufficiently well that no students withdrew from the courses due to computer problems and the WWW version of Learning Space™ has been retained for subsequent course offerings.

**Table I. Mean (SD) student attitudes toward Learning Space™ and self-assessment of computer skills (n = 12)<sup>a</sup>**

	Start of course	End of course	P <sub>b</sub>
Attitude toward Learning Space™ program	4.50(1.24)	5.42(1.44)	0.009
Self-perceived computer expertise	3.75(1.86)	4.83 (1.34)	0.015
Minimum perceived computer expertise needed to take Learning Space™ course	(Not measured)	3.00(1.10)	na

<sup>a</sup>Mean (SD) based on a seven-point Likert-type scale (1 = low, 4 = neutral, 7 = high).

<sup>b</sup>Student *t*-test for matched pairs.

## STUDY OBJECTIVES

The five courses listed above represented not only the pharmacy faculty's first use of Learning Space™, but also represented The University of Montana's first experience utilizing this technology. Priority was therefore given to conducting formative and summative assessments of these Learning Space™ courses. The objectives of the present project were to:

1. Measure student attitudes towards computers as learning tools in general and towards Learning Space™ in particular;
2. Compare student perceptions of their learning experiences in a "virtual classroom" environment to their perceptions of their previous live classroom experiences;
3. Obtain instructor impressions comparing the use of Learning Space™ as a teaching tool to approaches used in the traditional classroom; and
4. Assess student and instructor feedback regarding their Learning Space™ experiences to identify needed improvements.

## METHODS

Students enrolled in one of the Learning Space™ courses offered via during the 1997-1998 academic year were invited to participate in an anonymous evaluation of their Learning Space™ "classroom" experiences. A lengthy survey instrument was developed by the faculty coordinators of the courses. Along with student demographic information, the questionnaire surveyed student opinions about the Learning Space™ program itself, their attitudes toward using computers as learning tools, their attitudes toward participating in a "virtual classroom," and the usefulness of computer-based learning materials compared to other learning materials they had received for these courses. Student opinions regarding their interactions with the SysOp were also solicited. A copy of the survey instrument is available via e-mail from the lead author.

The survey was posted on the Internet, and students were invited via e-mail to participate. Students either completed the survey on-line or printed a hard copy of the survey and returned the completed instrument via surface mail. Completed electronic surveys were posted anonymously to a file accessible only to the course instructors. A reminder e-mail message was sent to all students one week after the survey was posted. Because of the anonymous nature of the study, follow-up with nonresponders was not possible. Ethical issues which might arise with any project of this type, including informed consent, student privacy, the voluntary nature of the project and possi-

**Table II. Mean (SD) student perceptions of educational experiences in a "Virtual Classroom" compared to their live classroom experiences (n = 12)<sup>a</sup>**

	Mean (SD)
Degree of self-discipline necessary to keep up with studies	4.82(1.25)
Interactions with instructors	4.75(1.66)
Presence of learning distractions	4.67(1.23)
Classmate contributions to learning	4.50(1.38)
Comfort level in asking instructors questions	4.42 (1.38)
Interactions with classmates	4.25 (1.54)
Instructor contribution to learning	4.18(1.25)
Effectiveness of instructor presentations	4.17(1-40)
Involvement in class discussions	4.08 (2.02)
Effectiveness of Learning Space™ as a learning method	3.58 (1.72)

<sup>a</sup>Mean (SD) based on a seven-point Likert-type scale (1 = much less than in classroom, 4 = same as in classroom, 7 = much greater than in classroom).

ble risks to respondents were addressed to the satisfaction of the university's Institutional Review Board.

Faculty involved in teaching the courses met informally to share experiences and discuss problems encountered in working with the Learning Space™ program. Faculty maintained logs of the time spent preparing and loading Learning Space™ course materials, the time spent in discussions and assessing learning in the virtual classroom, and the nature and frequency of problems encountered. The SysOp, likewise, maintained logs of time spent working on Learning Space™-related projects and crises.

Statistical analyses included descriptive statistics, paired and independent two-sample Student *t* Tests as appropriate. An alpha level of significance of 0.05 was selected. Analyses were conducted with SPSS for Windows, Release 8.0 software.

## RESULTS

Twelve completed questionnaires were received, ten being posted electronically and two received via surface mail, for an overall return rate of 63.2 percent. All questionnaires received were usable. Five of the respondents (42 percent) received BS Pharmacy degrees prior to 1994 while the remaining seven graduated in 1994 or later. Eight of the respondents (67 percent) had been in a classroom setting at least once since 1994. One-third of the respondents lived within 30 miles of the campus, while over half (7/12) lived more than 90 miles away.

Students' global attitudes towards Learning Space™ at the beginning of the academic term and their attitudes at the end of the term are summarized in Table I. Overall, respondents were favorably disposed toward Learning Space™ early in the term (assigning the program a mean rating of  $4.50 \pm 0.36$  on a seven-point Likert-type scale with 7 representing the highest score). This rating increased further to  $5.42 \pm 0.42$  by the end of the term ( $t = 3.19$ ;  $df = 11$ ;  $P = 0.009$ ).

Students were asked to react to this scenario: "If a course was offered both via Learning Space™ and in a live classroom setting, how likely would you be to recommend the Learning Space™ version of the course to a friend who lived in the same town where the university was located?" Respondents rated their likelihood of recommending the Learning Space™ version of the course as  $4.75 \pm 2.09$  on a seven-point Likert-type scale.

Table I also summarizes respondents' self-assessments of their computer skills prior to beginning their Learning Space™ course(s), at the completion of the course(s), and the level of computer expertise they felt would be required of any student

**Table III. Mean (SD) student attitudes toward interactions with system operator (SysOp) (n = 8)<sup>a</sup>**

	Mean (SD)
Satisfaction with SysOp response time to questions	6.71 (0.45)
Overall rating of interactions with SysOp	6.38(1.11)
Satisfaction with completeness of SysOp responses	6.12(1.27)
Comfort interacting with SysOp	5.38 (0.86)

<sup>a</sup>Mean (SD) based on a seven-point Likert-type scale (1 = low, 4 = neutral, 7 = high).

wishing to participate in a Learning Space™ course. Respondents indicated that prior to taking their first Learning Space™ course, on average they possessed what they perceived to be the minimum computer skills necessary to participate in the course; they further perceived that their computer skills improved during their Learning Space™ course ( $t = -2.86$ ;  $df = 11$ ;  $P = 0.015$ ).

Respondent attitudes towards their electronic interactions with their classmates and instructors are summarized in Table II. The scale midpoint value of “4” was labeled as “same as in classroom.” The mean responses for all items appear to cluster near the midpoint value of “4.”

The quality of interactions between respondents and the SysOp is summarized in Table III. Eight of the 12 respondents contacted the SysOp at least once during the term, rating their interactions with the SysOp as good to very good. Student comments addressed both the advantages and disadvantages of distance learning using asynchronous computer technology. Representative comments are listed in Table IV. Student comments also addressed the manner in which instructors used Learning Space™ to teach the courses. Several respondents noted that they would have preferred receiving a complete course schedule, including assignment due dates, at the beginning of the term, even if the modules themselves were not activated for student access until later in the term. This would help students to plan their time more effectively.

Respondents also cited occasions where instructors would add materials to a module after it had been posted for students to use, sometimes occurring after students considered themselves to have already completed the module. These students would then have no idea what topic classmates were discussing as they would not go back and search earlier modules for newly added materials. Respondents requested that instructors not post modules prematurely, and not add new material to modules once they were posted for student access.

Faculty reported getting to know their Learning Space™ students much more quickly and to a greater degree than their in-class students. Monitoring student participation in classroom discussions was also easier and more accurate in Learning Space™ courses because the program archives each electronic student and instructor comment throughout the term. Entire discussion threads arising from a single question or comment can easily be traced. This medium allowed instructors to identify “quiet” students who could then be prompted to respond to questions and provided time for students to formulate responses. As a result, a higher percentage of students participated in virtual classroom discussions than in the live classroom setting, permitting instructors to assess the individual progress of more students in a truly ongoing fashion. Student proficiency and mastery of material at any point in time was readily assessed based upon the sophistication of the questions students asked and of the responses they provided to class-

**Table IV. Representative student comments regarding their asynchronous virtual classroom experiences**

Positive Aspects:
A. “You can take the course as your schedule allows.... It is much more convenient and equally effective [as a live classroom environment].”
B. “More one-on-one interactions [with instructor]. I liked that a lot better than in a classroom.”
C. “I never got involved in class discussions [in a live classroom setting], but I was forced to get involved with Learning Space.”
D. “[Learning Space] allowed for more time to gather thoughts and analyze opinions before commenting.”
E. “I cannot say enough about how important it is to have instructors willing and able to communicate on a daily basis.”
Negative Aspects:
A. “Group projects are much, much, much more difficult over the Internet than in person.”
B. “It was sometimes hard to get the other people on the computer. In class you could just talk to the person....”
C. “I felt like I was on my own.... I’m not in the same room as others, and not even online at the same time.”
D. “I did not like printing out all those ‘lectures.’ I refused to stare at the computer and take the time to scroll between screens.”

mates’ questions or rebuttals.

A major disadvantage of the electronic classroom noted by faculty was that generating answers to Learning Space™ students’ questions required much more time than preparing answers for questions in the live classroom. A positive trade-off, however, was that the electronic classroom allowed faculty to formulate more detailed responses for Learning Space™ student questions than they might have provided to similar questions asked in a live classroom setting.

Faculty tracked the hours they spent preparing and loading material, monitoring discussions, and assessing student performance. Course material preparation and loading time varied from 72 to 398 hours for a mean  $\pm$  SD of  $187.6 \pm 83.8$  hours per instructor per course ( $n = 5$ ). The amount of time needed depended on whether the course was new or already in existence and the extent to which the instructor already had annotated notes from the classroom version of the course. Monitoring on-line discussions, responding to questions, and assessing students required an additional  $70.9 \pm 42.9$  hours on average per instructor per course. Overall, faculty estimated that they spent almost twice as many contact hours involved in virtual classroom teaching activities as they did for their live classroom courses.

The SysOp in the Center for Continuing Education was instrumental in ensuring that the external PharmD students had a successful educational experience. The SysOp estimated that he spent approximately 15 hours/week addressing students’ and faculty’s Learning Space™-related questions. This dropped to one hour/week after converting students to the WWW version. Specific problems included student hardware incompatibilities, unexpectedly low levels of student computer literacy, and lack of communication among faculty. In particular, the SysOp noted that poor communication between faculty who were either team-teaching the same Learning Space™ course or teaching different Learning Space™ courses led to duplicate calls for help or calls regarding problems the SysOp had already resolved.

## DISCUSSION

Various distance learning approaches for delivering post-sec-

ondary education in the United States have been evaluated for their acceptance by students and faculty. Students have reacted positively to audiotaped lectures(4,5), videotaped presentations(6) and online courses(5) while reactions to interactive compressed video have been mixed<sup>2</sup>(7,15-16).

Despite the many problems which initially plagued the use of Learning Space™ as a vehicle for offering nontraditional PharmD courses, students surveyed towards the end of the term rated this learning approach as quite acceptable. This finding is consistent with the results obtained by Pugh and Siantz in their study of compressed video(16), who discovered that student satisfaction with the technology significantly improved over the course of the term.

It is interesting to note that if a Learning Space™ course were also being offered in a live classroom setting, respondents were still likely to recommend that a friend enroll in the electronic version of the course, even if the student lived in the same town in which the university was located. This may imply that students perceived the time-flexibility and interconnectedness offered by an asynchronous learning approach such as Learning Space™ to balance out the disadvantages documented in this paper. It would be interesting in future studies of distance learning approaches to ask students to rank order the importance of different advantages and disadvantages of specific distance learning techniques.

Respondents implied that their virtual classroom experiences were similar to their previous live classroom experiences by rating, on average, the experiences around the midpoint value of "4" or "same as in classroom." Concern that students in distance education programs may feel more alone or isolated than their classroom counterparts was not supported by these midrange responses. Ratings by these students of feeling like part of a class and not floating alone in cyberspace are consistent with the findings of others using computer-based distance education(5).

The greatest perceived difference between respondents' virtual classroom and live classroom experiences arose in the area of respondents' need to exert more study self-discipline for their electronic courses than they had for their classroom courses. This response seems logical because Learning Space™ students participated in an environment where their classroom time was much less structured and greater self-motivation might be necessary for students to remain on schedule. Similar concerns have been expressed by students in earlier studies of distance education(6).

Students appeared equally comfortable participating in discussions in virtual and live classroom settings. The opportunity to take time to formulate questions and responses was noted as an advantage of the Learning Space™ program. It would be interesting to explore whether this would appear as a difference when larger class sizes or different types of technology are compared. That is, do students who are reluctant to join discussions in a large class feel more comfortable "participating" in virtual classroom discussions, and if so, why?

A surprising outcome was the improvement in mean perceived computer skills as students progressed through the Learning Space™ courses. The SysOp, faculty and the more computer-literate students in the Learning Space™ courses devoted several hours guiding less proficient students through computer "problems" specific to their particular machines.

Apparently, resolving these problems increased overall student confidence in their abilities to operate their computers.

Faculty gave guarded approval to Learning Space™ as a distance education approach. Learning to manipulate the program, developing course materials, and "teaching" in the virtual classroom all proved to be tremendously time-consuming activities. In fact, activities for electronic classes may consume almost twice as many hours as the same activities for the live classroom. Despite the time-intensive nature of electronic courses, however, faculty were able to familiarize themselves with students more quickly in the electronic courses than in a live classroom, to provide more detailed responses to student questions, and to more easily, completely and accurately monitor student participation and progress.

It should be apparent from the narrative presented above that the importance of having competent and unflappable technical support when offering any electronic course cannot be overstated. This point has been stressed by others using technology for providing distance education(5,15). The SysOp assigned to work with pharmacy faculty as they developed their courses was absolutely invaluable—he is primarily responsible for preventing the complete meltdown of the electronic courses during the first term of the program, and is owed much of the credit that The University of Montana's non-traditional PharmD program continues to exist in its present form.

The small number of student responses in the study sample could be considered to be a potential limitation of this project. However, as the sample accounts for over 60 percent of the population of interest, responses received were considered to be representative of all students enrolled in the distance education program. Statistical calculations were affected by the small sample size and a lack of statistical power may have contributed to the non-significant findings. Results of the t Tests should be interpreted with this in mind.

The results of this study may be generalizeable to non-traditional PharmD programs of similar size, regardless of geographic location. The outcome measures used in this study are also applicable to programs with larger enrollments, although it is not possible to predict the degree to which findings from larger programs might vary from the present findings.

## SUMMARY

Considering both the advantages and disadvantages of using Lotus Development Company's Learning Space™ software program to deliver nontraditional PharmD distance education courses, the program appears to be a viable alternative for providing distance education. Future studies into the use of this and other distance education approaches, utilizing larger sample sizes, are needed to validate the findings of this small pilot project. Learning Space™ needs to be compared to other distance education alternatives. Additional research should also be undertaken to compare the academic and practice performance of students enrolled in Learning Space™ distance education courses and those enrolled in equivalent live classroom courses.

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