Survey of Technology Use at Colleges and Schools of Pharmacy in 2006: An Exploratory Study

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ABSTRACT. The purpose of this study was to evaluate the degree of technology adoption and application within colleges and schools of pharmacy. The project was an exploratory study using a 25-question online survey delivered to a convenience sample of representatives from each of 97 schools and colleges of pharmacy in the United States. Forty-four online surveys were completed from the 90 individuals contacted yielding a 48.9% response rate. Based on the findings of this study it can be concluded that technology adoption of various kinds is taking place within colleges and schools of pharmacy and the most significant reasons driving that change were increased student technological literacy and enhancing student learning. Finally, the occurrence of online activities within schools and colleges of pharmacy was found to be more common for the more static types of online activities (PowerPoint slides, notes, syllabi) and faculty development initiatives were consistent with the common online activities identified. doi:10.1300/J060v14n02_07

KEYWORDS. Pharmacy education, online learning, technology adoption, instructional technology

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Journal of Pharmacy Teaching, Vol. 14(2) 2007
Available online at http://jpt.haworthpress.com

doi:10.1300/J060v14n02_07

INTRODUCTION

There has been a lot of change within pharmacy education over the past 15-years as schools and colleges of pharmacy, either independently or through their University, have invested in the use of technology as it relates to the processes of teaching, learning and assessment. This investment, which can be quite costly, does not always translate into program adoption of technology or the appropriate use of technology when adoption occurs.

In 2006 it was reported that colleges will spend $6.94 billion dollars on information technology with average technology budgets at colleges of $1.4-million; within private institutions the average was $1.3-million and for public institutions it was $1.6-million. The range was $600,000 from the smallest colleges to $11.5 million to large programs with more than 25,000 students (1). This spending, which has seen a dramatic increase over the past ten to fifteen years, corresponds to the amount of technology use now being reported by colleges and universities throughout the United States.

According to a national study of college students regarding technology use "Students preferred a moderate use of Instructional Technology in their courses and expect faculty to use technology well." In addition "The primary benefit of technology in courses is convenience, followed by connectedness" and 41% of the students said they preferred their professors to use information technology moderately in class (2). Students in the survey most commonly said that convenience was the primary benefit of the use of technology in courses and that virtual connectivity was second. The same survey also found that students attending college brought along technology other than computers. When students were surveyed whether they owned different technologies, such as a desktop computer, laptop, PDA, smart phone, cellphone, music device, or wireless adapter, the response indicated that students owned an average of 2.8 categories of the devices (2).

In a study by Hawkins et. al. on student use of technology over 57% of respondents indicated that their colleges provide wireless access, a 15% increase from the previous year (2003). In addition, 34% of respondents indicated that their colleges had wireless access in classrooms (3). Finally, according to a recent study by the Alliance for Higher Education Competitiveness there are increasingly more fully online programs and hybrid/blended programs as well as growth in online individual courses (4, 5). Within the same study reasons were identified as motivations for online initiatives and included growing student

enrollments, improved teaching, meeting the needs of non-traditional students, greater access to learning, enhanced student services, increased enrollment and student preference to use technology (5).

Due to the challenges and expense associated with the use of technology, it seemed appropriate to determine what current technology adoption was within pharmacy education and how technology was being used with respect to teaching, learning, and assessment. The purpose of this study was to evaluate the degree of technology adoption and application within colleges and schools of pharmacy.

METHODS

This was an exploratory study using a 25-question survey delivered via SurveyMonkey, a proprietary software package (www.surveymonkey.com; Portland, Oregon) designed for conducting online surveys. A convenience sample comprised of one representative from the American Association of colleges of Pharmacy Council of Deans at each of 97 schools and colleges of pharmacy was used. A convenience sample is a non-probability sampling procedure with diminished generalizability in which subjects are chosen by availability or purpose. Every effort was made to contact the individual identified with academic affairs but this was not always possible.

Data collection was accomplished using a modified Dillman methodology with considerations made for the use of email. Briefly, Dillman's survey distribution and recovery methodology proposes prior notification, the first survey mailing, a reminder, and finally a second mailing of the survey. Each survey of the mailing includes a postage paid return and the entire time frame for this from start to finish is about 4 weeks (6). Within this study the use of email for the notifications allowed for a collapsing of the time table normally followed in traditional or modified Dillman methodologies. Three emails were sent with login instructions to the survey and the link to the survey over a two-week period of time in the winter of 2006.

RESULTS

Of the 97 individuals contacted for the study, seven emails did not reach the intended individual, yielding an accessible sample of 90.

Forty-four online surveys were completed from the 90 individuals contacted yielding a 48.89% response rate.

Respondents were first asked questions regarding learning management systems (LMS) regarding use, selection, cost and support. A LMS is a software application or Web-based technology used to develop, deliver, and evaluate learning processes. As is evident within Figure 1, the majority of respondents are using either BlackBoard (54.5%) or WebCT (31.8%), which due to the WebCT acquisition by BlackBoard makes the collective response over 86%. In over 40% of the responses the University alone selected the LMS and in 34.1% of the responses the decision included input by the academic programs including the school of pharmacy. The complete results are available in Figure 2. Over 62% of respondents indicated that the costs for the LMS were covered by the University alone (Figure 3) and in 58% of the responses support for technology initiatives was shared between the University and School of Pharmacy with the University providing sole support in 30% of the cases (Figure 4).

Next respondents were asked about the technology environment at their respective institution. According to respondents 65.1% indicated that the primary place for course offerings was wireless, 34.1% had a laptop or learning technology requirement, 66% had students bringing personal laptops to class and 75% indicated that their college of pharmacy had an inappropriate use of technology policy. It was also identi-

FIGURE 1. Learning Management System Currently Used

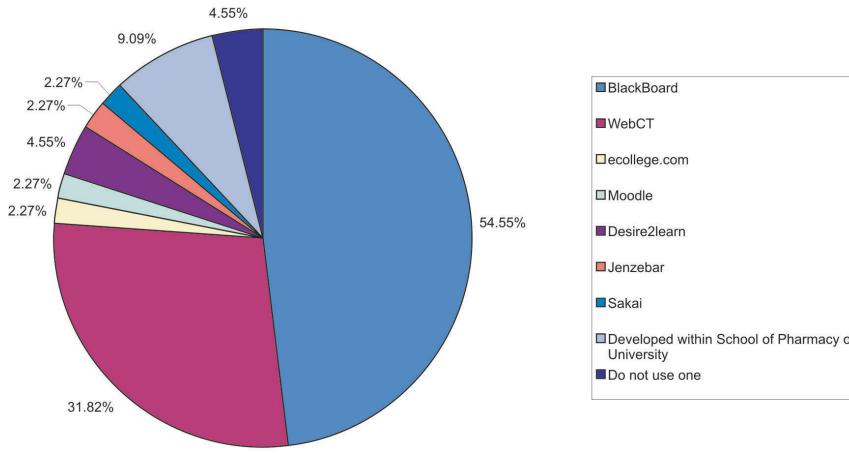


FIGURE 2. Decision to Purchase Learning Management System

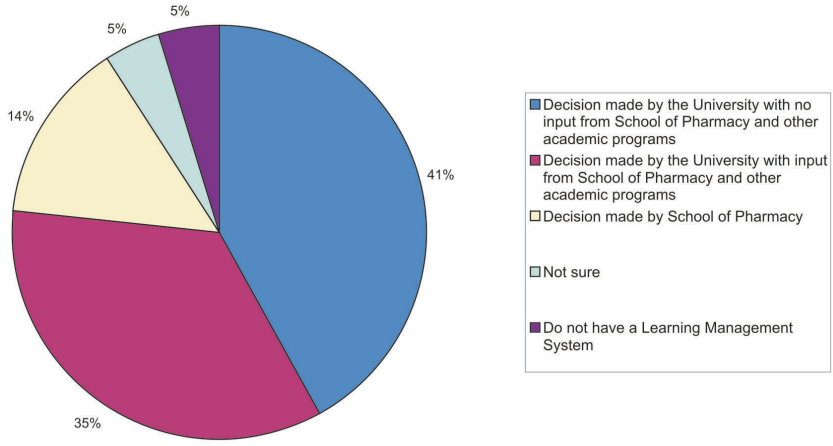
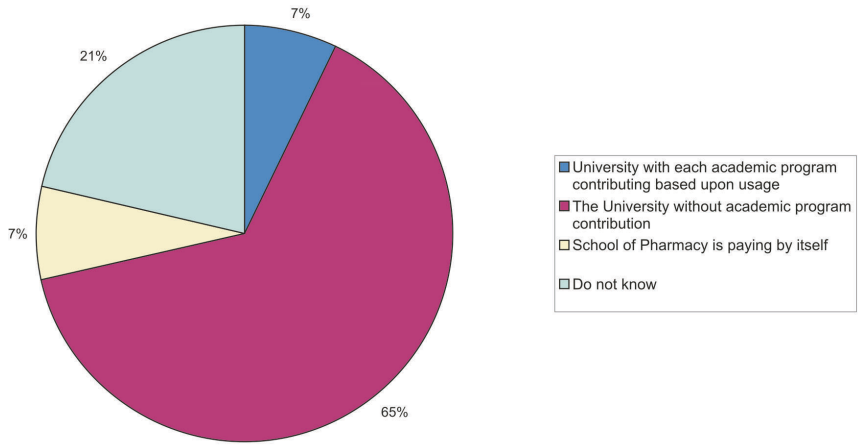
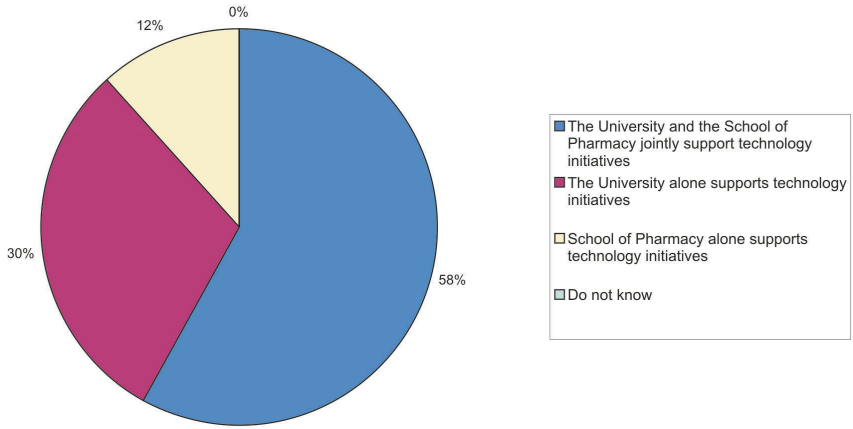


FIGURE 3. Costs for Learning Management System



fied that hand-held devices were integrated more into experiential education than the classroom (50% vs. 25.6%). Slightly more than 29% of the respondents indicated use of personal response station technology and over one-third indicated the use of an e-portfolio. With respect to distance education, respondents indicated that in 93% of the cases the University was engaged in distance education versus 50% for the

FIGURE 4. Providing Technology Support for School of Pharmacy Technology Initiatives



School of Pharmacy. Finally, no respondent indicated that cell phones have been integrated into teaching. The complete results can be found in Table 1.

Also identified within the survey were possible reasons for a school of pharmacy to use learning technologies (laptop, PDA, cell phone, etc.). According to respondents the top three reasons were increased student technological literacy (81.4%), enhancing student learning (79.1%), and student expectation to be able to use technology (72.1%) with the complete results available in Table 2. In contrast were the challenges or barriers to learning technology use and adoption. Six of eight challenges or barriers were identified by at least 50% of the respondents; the two most common reasons were students not paying attention in class and faculty not using technology appropriately to teach. The complete results can be found in Table 3.

The final two sections of the survey evaluated the faculty development opportunities provided within schools of pharmacy and the frequency of occurrence of various online activities. The two most common faculty development topics were PowerPoint and online assessment (85.4% and 61% respectively) with the least common being using streaming audio (17.1%). The complete results can be found in Table 4. With respect to the frequency of occurrence for various online activities by faculty, the highest occurrence was providing a syllabus, class notes, or PowerPoint slides online with low occurrences for the

TABLE 1. Technology environment within the School of Pharmacy questions; responses with % in ( ); N = 44

Abridged survey questions	Positive Response
School of Pharmacy or the primary place for course offerings is wireless	28 (65.1)
Students within the School of Pharmacy are bringing personal laptops to class while enrolled	29 (65.9)
Students within the School of Pharmacy required to have a laptop or similar learning technology while enrolled	15 (34.1)
Hand-held devices (PDA, IPAC, etc.) been integrated into the "experiential" educational experience within the School of Pharmacy	22 (50.0)
Hand-held devices (PDA, IPAC, etc.) been integrated into the "classroom" educational experience within the School of Pharmacy	11 (25.6)
Students within the School of Pharmacy using response station technology (e.g. TurningPoint, eInstruction, etc.) in the classroom	15 (29.4)
Students within the School of Pharmacy using a web enabled online portfolio	15 (34.9)
The University provides coursework via distance education	41 (93.2)
The School of Pharmacy provides coursework via distance education	22 (50.0)
Cell phones been integrated into teaching within the School of Pharmacy	0 (0.0)
School of Pharmacy have an academic policy specific to the inappropriate use of technology (computers, cell phones, etc.) by students	33 (75.0)

online activities being synchronous discussions, collecting assignments online and simulations. The complete results can be found in Table 5.

DISCUSSION

Based on the results the majority are using either BlackBoard or WebCT. BlackBoard's 2006 acquisition of WebCT has interesting implications in the two market leaders are now combined. Some in the industry have raised concerns regarding how this will affect customers of both platforms, especially given the current turbulence in the e-learning market and if both platforms slowly combine over time (7).

TABLE 2. Reasons for using learning technologies (laptop, PDA, cell phone, etc.) within School of Pharmacy; responses with % in ( ); N = 44

Statements	Response
Increases student technological literacy	35 (81.4)
Enhances student learning	34 (79.1)
Students expected to be able to use technology	31 (72.1)
Consistent with School of Pharmacy mission	26 (60.5)
Prepares students for an evidence-based approach to care	25 (58.1)
Prepares students for data management	20 (46.5)
Faculty recommended adoption	20 (46.5)
To stay competitive (i.e. other pharmacy programs are using learning technologies)	15 (34.9)
Administration recommended adoption	12 (27.9)

TABLE 3. Challenges or barriers to using learning technologies (laptop, PDA, cell phone, etc.) within School of Pharmacy; responses with % in ( ); N = 44

Statements	Response
Student not paying attention in class	31 (73.8)
Faculty not using technology appropriately to teach	31 (73.8)
Inappropriate student use of technology in class	29 (69)
Hardware support concerns	25 (59.5)
The expense	25 (59.5)
Software support concerns	24 (57.1)
Academic integrity issues (cheating plagarism, etc.)	16 (38.1)
Inhibits student learning	9 (21.4)

TABLE 4. Faculty development within the School of Pharmacy includes which of the following topics; responses with % in ( ); N = 44

Statements	Response
PowerPoint	35 (85.4)
Online assessment	25 (61.0)
Response station technology	12 (29.3)
Using asynchronous (non-real-time) discussion forums	11 (26.8)
Using simulations	9 (22.0)
Using streaming video	9 (22.0)
Using synchronous (real-time) discussion forums	9 (22.0)
Using streaming audio	7 (17.1)

TABLE 5. Statements of occurrence within Schools of Pharmacy by frequency

	Not at all	Up to 19% of the time	20 – 39% of the time	40 – 59% of the time	60 – 79% of the time	80 – 100% of the time
Provide syllabus online	2% (1)	7% (3)	2% (1)	5% (2)	20% (9)	64% (28)
Provide class notes online	2% (1)	11% (5)	16% (7)	14% (6)	20% (9)	36% (16)
Provide PowerPoint slides online	0% (0)	5% (2)	9% (4)	28% (12)	23% (10)	35% (15)
Provide audio online	43% (19)	34% (15)	14% (6)	2% (1)	2% (1)	5% (2)
Provide video online	41% (18)	36% (16)	9% (4)	5% (2)	7% (3)	2% (1)
Conduct classroom assessments online	23% (10)	21% (9)	12% (5)	7% (3)	12% (5)	26% (11)
Conduct online asynchronous (non-real time) discussions	30% (13)	48% (21)	14% (6)	7% (3)	2% (1)	0% (0)
Conduct online synchronous (real time) discussions	52% (23)	41% (18)	2% (1)	5% (2)	0% (0)	0% (0)
Provide students access to his/her grades	14% (6)	2% (1)	5% (2)	5% (2)	9% (4)	66% (29)
Provide simulations	30% (13)	43% (19)	16% (7)	7% (3)	2% (1)	2% (1)
Collect assignments online (other than via email)	11% (5)	36% (16)	25% (11)	16% (7)	7% (3)	5% (2)
Provide class announcements online (other than via email)	5% (2)	14% (6)	23% (10)	23% (10)	23% (10)	14% (6)

According to the findings the University was a driving force when considering the selection of a learning management system. The overall influence of the University in choosing a learning management system makes sense given who is incurring the costs, which according to the findings was overwhelmingly at the University level without academic unit contribution. University involvement may also be driven by the fact that the adoption of learning management systems is usually a campus-wide issue, not an independent program initiative, so the centralization of funding and support would naturally follow. Not addressed in this study was the breaking apart of technology support to determine whether it was maintaining servers, laptop support, etc., which should be studied more in subsequent research.

Much has been made about the need to integrate technology into pharmacy education, both didactically and experientially. Based upon the results it seems that through laptop initiatives, students bringing personal laptops to class, and the integration of handheld devices into the classroom educational experience it appears that the use of technology is becoming more pervasive in the classroom. It was interesting that while 65% of respondents indicated that the primary place of instruction was wireless. Access to a wireless network by itself introduces the opportunity to get technology into the classroom by the students and can offer a starting point for programs considering technology initiatives.

Findings indicated that the integration of handheld devices (PDA, Dell Axim, etc.) into the educational process occurred twice as often into experiential education as into the classroom. This could be a result of the limited application of the handheld device in the classroom versus in an experiential setting where it can serve as a repository for reference materials, patient data, and other information. Taking notes, preparing presentations and writing papers might be easier when the learner has a keyboard and a mouse versus using the stylus pen from a handheld device. This could change with the adoption of tablet personal computers but these devices are still fragile enough to prevent large scale adoption and are still more expensive than laptop alternatives.

Technology support is expensive and is a necessity when students are held accountable based upon their use of the technology, such as taking an online examination in class. Several challenges exist when students bring their own laptops as opposed to participating in a required laptop initiative, and the most difficult one is that of support due to a lack of standardization of technology. A second challenge is what you can require the student to do using technology if not every student is required to have a laptop. For example, using online testing becomes more diffi-

cult for classroom assessments unless every student has a laptop and access to the testing software or the program uses a computer lab (testing center) for the assessment. Careful consideration should be given regarding how the faculty intend to use technology before deciding on whether to have a technology requirement or to make it optional. The fact that over 75% of respondents indicated that their program had an inappropriate technology use policy suggests a need by programs to ensure that classroom technology is being used for the appropriate purposes.

As indicated within the findings, a little less than one-third of the respondents indicated that response station technology was being used in the classroom and with round one-third of students using e-portfolios. Response stations allow for real-time formative and summative assessment of student understanding and performance in the classroom and in many instances do not require a wireless environment or the presence of laptop computers. Response stations can vary in cost from $30 to $120 with possible additional costs to the student or institution (receivers, software, license renewal, etc.). The reasons for the limited adoption could be due to a variety of reasons, two of which are cost as well as comfort with the technology. Some of the devices and corresponding software are easier to use than others and time should be spent researching the different types and models before considering adoption. Regardless of the reason, overcoming fear of the unknown that accompanies new technologies can create a substantial barrier to adoption. Finally, time and expertise to provide faculty development is a must to ensure adoption and long term use.

E-portfolios are an online version of the traditional portfolio and like the response stations are available from a variety of vendors with varying costs and levels of complexity. E-portfolios represent a way for faculty to create an online dynamic portfolio requiring a vast array of learning artifacts (writings, reflections, presentations, audio recordings, video recordings, etc.) and then view student works to provide feedback and facilitate student learning. In addition they can provide an insight into how well students are integrating different curricular competencies and can be mined to assess curricular effectiveness (8). Finally, the reason for limited adoption could be due to a variety of reasons and it might be inappropriate to assume that the adoption rate of 34% is low given that the degree to which traditional portfolios are used within pharmacy education is not well known.

The previous discussions regarding the use and adoption of various technologies begs the question regarding what is either driving or hin-

dering technology adoption. The reasons and barriers for technology adoption found within this study involve issues and concerns outside of the control or scope of the pharmacy program and are consistent from other literature findings (9). Within the barriers and limitations section of the survey many respondents had more than one prominent concern and six of the nine choices were indicated by at least fifty percent of the respondents. Overcoming these barriers poses an interesting challenge because the concerns can be both real and theoretical. In some instances an institution of higher education might not have the resources necessary to support an online program while in other instances the concerns are based upon anecdotal evidence and not upon a true understanding of the institution's technology infrastructure, potential and support for faculty and students.

Specific to pharmacy, the findings that technology adoption enhances student learning and increasing technology literacy are indications of the value of technology and the benefits to the learner. In addition, the finding from this study that students expect to use technology is consistent with the literature regarding increased student technology literacy and utilization that is being seen throughout higher education (2).

Based upon the findings the integration seems more common with the static online activities (providing a syllabus, class notes, PowerPoint slides, online assessments, etc.) versus the less common online activities of the more dynamic and more difficult activities (audio, video, asynchronous and synchronous discussions, collecting assignments online and simulations). One possibility is that technology adoption is linked to the ease of use, which translates into the more dynamic means taking more time, requiring more faculty development, and resulting in lower adoption rates. The other reason for the low adoption by faculty could be that not all technologies lend themselves to meeting the course outcomes and more dynamic technology does not mean better learning. It should also be noted that the more faculty time spent on using the more time consuming aspects of e-learning can take time from the requirements of research and service. Finally, as indicated earlier, adoption could be related to faculty development and further study on the relationship of faculty development to technology adoption should be considered.

As evident within the faculty development results, everything other than how to use PowerPoint and the use of online testing was indicated less than 35% of the time. A relationship could exist between the type of online offerings available and the amount of faculty development being provided on those topics. This could also be due to the ease of adoption;

the more dynamic e-learning tools require more faculty development, more faculty time to develop content, and more technology support as well as better preparation of the learner to access and utilize the materials. This study did not evaluate the relationship between technology use and faculty development but one could speculate that the more faculty development is offered, the better the chance for technology adoption. Further study in this area should be considered.

Finally, according to the findings there was more distance education occurring at the University than within pharmacy programs. The differences between academic disciplines provide some with more distance education opportunities than others, which could partially explain the disparity between the University and pharmacy programs. Another reason could be due to the amount of technology adoption on-campus, which is usually a precursor to the start of a distance education endeavor. The blending of technologies both in the classroom to fully online programs provides an opportunity for programs to learn about using technology locally on campus and then expanding on that knowledge to venture into distance learning.

Finally, it should be noted that the adoption of technology on campus represents a means of modeling appropriate technology use to our graduates and future practitioners. Mobile technologies, albeit laptops, tablet PCs, or handheld devices, are becoming more common place within the health care system and not exposing our students to these devices and their uses in school could indeed be a missed opportunity. The use of mobile technologies for retrieving prescribing information, patient documentation, and e-prescribing are but a few examples of how health care delivery is changing and maybe exposing students to the technology early, often, and appropriately would prepare them for a changing future.

Within this study several limitations several limitations existed. First, the response rate of 48.89%, while acceptable, could have been higher. Second, the results of the survey are based upon the respondent's understanding of his or her institution and could therefore contain some bias in the event the respondent's level of understanding of the technology was incomplete or did not accurately reflect either technology use or decision making.

CONCLUSION

Based on the findings of this study it can be concluded that technology adoption of various kinds is taking place within colleges and

schools of pharmacy and the most significant reasons driving that change were increased student technological literacy and enhancing student learning. Finally, the occurrence of online activities within schools and colleges of pharmacy was found to be seems more common for the more static types of online activities (PowerPoint slides, notes, syllabi) and faculty development initiatives were consistent with the common online activities identified.

Received: May 31, 2007
Reviewed: June 29, 2007
Revised: July 5, 2007
Reviewed and Accepted: July 8, 2007

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doi:10.1300/J060v14n02_07