# TECHNOLOGY IN PHARMACY EDUCATION

## Student Pharmacists' Use and Perceived Impact of Educational Technologies

Scott K. Stolte, PharmD, Craig Richard, PhD, Ateequr Rahman, PhD, and Robert S. Kidd, PharmD, PhD

Bernard J. Dunn School of Pharmacy, Shenandoah University

Submitted March 14, 2011; accepted April 29, 2011; published June 10, 2011.

**Objective.** To assess the frequency of use by and perceived impact of various educational technologies on student pharmacists.

**Methods.** Data were obtained using a validated, Web-based survey instrument designed to evaluate the frequency of use and impact on learning of various technologies used in educating first-, second-, and third-year student pharmacists. Basic demographic data also were collected and analyzed.

**Results.** The majority (89.4%) of the 179 respondents were comfortable with the technology used in the academic program. The most frequently used technologies for educational purposes were in class electronic presentations, course materials posted on the school Web site, and e-mail. The technologies cited as having the most beneficial impact on learning were course materials posted on the Web site and in-class electronic presentations, and those cited as most detrimental were video-teleconferencing and online testing. Compared to the course textbook, students reported more frequent use of technologies such as electronic course materials, presentations, digital lecture recordings, e-mail, and hand-held devices.

**Conclusions.** Because students' opinions of educational technologies varied, colleges and schools should incorporate educational technologies that students frequently use and that positively impact learning.

**Keywords:** technology, pharmacy student, learning preferences, teleconferencing, Web, e-mail



## INTRODUCTION

The use of emerging hardware and software technologies is an established trend in educational settings.[1] The current criteria for the selection and integration of specific technologies into an educational process commonly includes cost effectiveness, usability, reliability, contemporary expectations of technology skills, and innovative potential. An increasing area of focus is the effect technology may have on the learning process and learning outcomes.[2-5]

In one study, undergraduate students rated classroom technologies as having a beneficial effect (eg, electronic class discussions), a detrimental effect (eg, using e-mail to communicate with classmates and instructors), or lacking a significant effect (eg, developing a multimedia presentation) on the education process/their education.[6] Several studies of pharmacy programs have investigated the effect of technology-mediated distance education compared to traditional classroom learning with conflicting findings: one study showed that technology-mediated distance education was more beneficial, one found it less beneficial, and one determined it had no effect on student learning outcomes.[7-9]

**Corresponding Author:** Scott K. Stolte, PharmD, Associate Dean, Academic Affairs, Bernard J. Dunn School of Pharmacy, Shenandoah University, 1460 University Drive, Winchester, VA 22601.

The Bernard J. Dunn School of Pharmacy at Shenandoah University in Winchester, Virginia, was created as a 4-year doctor of pharmacy (PharmD) program with a strong focus in information technology.[10] In 1997, one year after opening its doors to students, the school became one of the first in the nation to require students to use school-provided laptops in the program.[11] The students were charged a technology fee to cover the cost of the laptop and associated technology support. In 1998, the school initiated a nontraditional pharmacy program that involved the repackaging and administration of the pharmacy curricula to distant students primarily via electronic slide files, audio recordings, e-mail, online testing, Internet chat rooms, and Web-based threaded discussion forums.[12] Online testing software for traditional student examinations also was initiated in 1998, and continues to be used in many courses in the first 3 professional years at the discretion of the course coordinator. The conversion of wired Ethernet connections for the student laptops to wireless technology occurred in 1999.[12] The first few years of the program saw an increasing use of e-mail, electronic slides, instant messaging, threaded discussion tools, and online testing for delivering and teaching the curricular content.

In the fall of 2006, a new satellite campus was opened in Ashburn, Virginia, that included approximately 20% of first-year students. Synchronous video teleconferencing was incorporated in the spring semester to facilitate the delivery of content between the Winchester campus and the new satellite campus. As of 2010-2011, first-year students in Ashburn received about 65% of their lectures via video teleconferencing , while the remainder of first-year students at the Winchester campus received about 20% of their lectures via video teleconferencing.

In 2009, Shenandoah University began providing an Apple Macbook Pro laptop (Apple Inc., Cupertino, CA) and an Apple iPhone or Apple iPod Touch to all incoming students as part of a new Apple platform-based initiative. Several other technologies were specifically introduced into the pharmacy program in 2009. These new technologies enabled the recording and online posting of audio and video files of most lectures, as well as the incorporation of an electronic student/audience response system. Most lecture-based courses in the PharmD curriculum use online course material, in-class electronic presentations, digital audio or video recordings of lectures, and e-mail.

Creating appropriate instruments and methodologies to assess specific technologies and deciding which education-related outcomes to measure is a challenge.[13-15] Additionally, assessing the technologies that students perceive as beneficial or detrimental to their learning may help highlight potential problem areas.[15] Students' technology preferences may be the next highly important variable in the selection criteria for instructional technologies. Our aim was to assess students' use and perceptions of several specific technologies used in our pharmacy program.

## METHODS

A survey was conducted in spring 2010 of all first-, second-, and third-year (P1, P2, and P3) student pharmacists at Shenandoah University. The survey instrument was drafted by the authors and subsequently revised after pilot testing on 10 students. The ambiguity of the survey instrument was assessed for flow and format of the instructions and also for the respondents' comprehension of the words used in the questionnaire. An a priori level of 80% or greater consensus among the respondents was set and accepted. The reading comprehension difficulty of the questionnaire was measured using the Flesch reading score and the Flesch-Kincaid grade level.[16] An a priori grade level of 12 or less was set due to the various technology names used in the survey instrument. The Flesch reading ease score was 42.9, which equates to a grade 11 Flesch-Kincaid reading level. The Flesch reading ease score is based on a range of 0-100, with lower values for harder text and higher values for easier text. The Flesch-Kincaid Grade Level Formula translates the 0-100 score to a US grade level, making it easier to judge the readability level of various books and texts. The Likert-type scale used for responses was tested for reliability using Cronbach's coefficient alpha and determined to be 0.96.[17] Most educational tests have a reliability of 0.40 to 0.95.[18]

The survey instrument was created via SurveyMonkey (Portland, OR). Students were sent an e-mail containing a link to the survey instrument. Although the survey was completed online, this was done in the classroom. The survey instrument stated that all responses would remain confidential and that completion of the survey instrument indicated consent for their responses to be included in the study. The survey contained 9 multiple-choice questions and 3 open-ended questions. The students were surveyed about their comfort level with frequency of use of, preferences for, and perceived utility of specific technologies associated with their academic program. Demographic factors including gender, age range, and undergraduate degree status also were collected. The open-ended questions were categorized and coded based on the 11 educational technologies identified in the survey instrument.

A cross-tabulation analysis of the impact and frequency of use of the technology indicated that some response choices were either infrequently chosen or not chosen at all. Therefore, bivariate variables were created by combining the ratings "very beneficial," "beneficial," and "indifferent" as beneficial; and "detrimental" and "very detrimental" as detrimental. Similarly, the frequencies of use of various technologies were combined: "more than 10 times per week," "6-10 times per week," and "3-5 times per week" as frequent, and "1-2 times per week" and "less than 1 time per week" as infrequent.

The completed survey instruments were coded and analyzed using the SPSS, version 16. (IBM SPSS, Chicago, IL) A series of descriptive analyses were performed on the demographic variables. Chi-square tests were used to test the research hypotheses. A 0.05 probability level was considered significant for all analyses. The study was reviewed and approved by the Shenandoah University Institutional Review Board.

## RESULTS

The survey instrument was sent to 228 P1, P2, and P3 student pharmacists and 179 completed it for a response rate of 78.5%. The percentages of respondents who had an undergraduate degree, were female, and were below the age of 25 years were consistent with those percentages for the overall student population (Table 1). The number of respondents also were fairly evenly split among professional years.

Overall, 89.4% of the respondents were comfortable or very comfortable with technology. Male students were more comfortable with technology than female students

Table 1. Demographics of Pharmacy Students Completing a Survey Instrument on Use and Value of Educational Technologies

| Variable | Survey Respondents, No. (%) |
|---|---|
| Female | 98 (54.7) |
| Earned undergraduate degree | 137 (76.5) |
| Age range | |
| Less than 25 years old | 88 (49.2) |
| 25 to 30 years old | 80 (44.7) |
| More than 30 years old | 11 (6.1) |
| Professional Year | |
| P1 | 63 (35.2) |
| P2 | 54 (30.2) |
| P3 | 62 (34.6) |

($p < 0.001$). There was no significant difference in comfort level with technology between students less than 25 years old and older students ($p = 0.326$), among professional years ($p = 0.456$), and with or without an undergraduate degree ($p = 0.175$). Students most frequently accessed online course materials (eg, schedule, syllabi, presentation files, lecture recording, and homework assignments) from a classroom or from off-campus housing. School computer laboratories, the school library, on-campus housing, workplace, and commercial establishments were rarely the settings where students accessed online course material.

The most frequently used technologies for educational purposes were in-class electronic presentations, course materials posted on the school Web site, and e-mail (Table 2). There were no significant differences in use by gender, age, or attainment of an undergraduate degree. However, there were several differences among professional years. Use of handheld devices was significantly higher among P1s compared to both P2s and P3s ($p < 0.001$), as was use of video-teleconferencing ($p < 0.001$). Compared to P1s and P3s, P2s used threaded discussions more frequently ($p = 0.009$), used e-mail for educational purposes less frequently ($p = 0.006$), and used online testing less frequently ($p = 0.017$). The use of student/audience response systems was more frequently used by P2s and P3s compared to P1s ($p < 0.001$). P3s more frequently: accessed course materials from the school Web site compared to P1s and P2s ($p = 0.036$), used in-class electronic presentations ($p = 0.005$), and viewed digital video files ($p < 0.001$). Students' reported use of textbooks declined as they advanced through the program ($p = 0.009$).

Students responded that course materials posted on the school Web site, in-class electronic presentations, and e-mail had the most beneficial impact on their learning (Table 3). There were no significant differences in the impact the different technologies had on learning based on gender. However, the availability of digital video files ($p = 0.035$) and student/audience response systems ($p = 0.004$) had a more beneficial impact on learning among students older than 25 years than on younger students. Students with an undergraduate degree were more likely to report that threaded discussions had a positive impact on their learning compared to those

Table 2. Rank Ordered Frequencies of Use of Different Technologies and Resources for Educational Purposes

| Technology or Resource | Mean (SD)[a] | More than 10 times per week N(%) | 6-10 times per week N(%) | 3-5 times per week N(%) | 1-2 times per week N(%) | Less than 1 time per week N(%) |
|---|---|---|---|---|---|---|
| In-class electronic presentations | 4.48 (0.88) | 117(66.9) | 35 (20.0) | 16 (9.1) | 4 (2.3) | 3 (1.7) |
| Course material posted on website | 4.33 (0.91) | 101(57.4) | 41 (23.3) | 26 (14.8) | 7 (4.0) | 1 (0.6) |
| Email | 4.09 (1.11) | 88 (51.2) | 31 (18.0) | 38 (22.1) | 10 (5.8) | 5 (2.9) |
| Digital audio files | 2.92 (1.37) | 32 (18.2) | 30 (17.0) | 37 (21.0) | 46 (26.1) | 31 (17.6) |
| Digital video files | 2.18 (1.32) | 19 (10.9) | 10 (5.7) | 25 (14.4) | 50 (28.7) | 70 (40.2) |
| Video-teleconferencing in class | 2.15 (1.43) | 19 (10.8) | 18 (10.2) | 27 (15.3) | 18 (10.2) | 94 (53.4) |
| Online testing | 2.13 (0.86) | 6 (3.4) | 5 (2.8) | 26 (14.8) | 108(61.4) | 31 (7.6) |
| Handheld device | 1.86 (1.25) | 13 (7.4) | 11 (6.3) | 15 (8.6) | 36 (20.6) | 100(57.1) |
| Course textbook | 1.82 (1.08) | 6 (3.4) | 11 (6.3) | 20 (11.4) | 47 (26.9) | 91 (52.0) |
| Audience response systems | 1.73 (0.93) | 4 (2.3) | 4 (2.3) | 21(12.1) | 57 (32.8) | 88 (50.6) |
| Instant messaging tools | 1.71 (1.34) | 19 (10.9) | 5 (2.9) | 10 (5.7) | 14 (8.0) | 127(72.6) |
| Threaded discussion tools | 1.27 (0.61) | 1 (0.6) | 0 | 9 (5.1) | 25 (14.2) | 141(80.1) |

[a] based on a 5-point Likert scale anchored at 5 = more than 10 times per week and 1 = less than 1 time per week

Table 3. Rank Ordered Perceived Impact of Different Technologies and Resources on Learning

| Technology or Resource | Mean (SD)[a] | Very Beneficial N (%) | Beneficial N (%) | Indifferent N (%) | Detrimental N (%) | Very Detrimental N (%) |
|---|---|---|---|---|---|---|
| Course material posted on Web site | 4.8 (0.5) | 140 (79.1%) | 33 (18.6) | 2 (1.1) | 2 (1.1) | 0 |
| In-class electronic presentations | 4.7 (0.6) | 134 (75.7) | 33 (18.6) | 8 (4.5) | 2 (1.1) | 0 |
| Email | 4.5 (0.7) | 108 (61.0) | 58 (32.8) | 7 (4.0) | 4 (2.3) | 0 |
| Digital audio files | 4.2 (0.8) | 80 (45.2) | 49 (27.7) | 37 (20.9) | 2 (1.1) | 0 |
| Online testing | 4.0 (1.0) | 65 (36.7) | 69 (39.0) | 29 (16.4) | 9 (5.1) | 4 (2.3) |
| Digital video files | 4.0 (0.9) | 60 (33.9) | 44 (24.9) | 52 (29.4) | 2 (1.1) | 1 (0.6) |
| Handheld device | 3.6 (0.8) | 19 (10.7) | 53 (29.9) | 63 (35.6) | 2 (1.1) | 1 (0.6) |
| Course textbook | 3.5 (0.8) | 14 (7.9) | 53 (29.9) | 76 (42.9) | 3 (1.7) | 3 (1.7) |
| Instant messaging tools | 3.4 (0.7) | 13 (7.3) | 29 (16.4) | 77 (43.5) | 4 (2.3) | 0 |
| Video-teleconferencing in class | 3.3 (0.9) | 21 (11.9) | 28 (15.8) | 75 (42.4) | 16 (9.0) | 3 (1.7) |
| Audience response systems | 3.3 (0.8) | 14 (8.0) | 41 (23.3) | 87 (49.4) | 9 (5.1) | 4 (2.3) |
| Threaded discussion tools | 3.1 (0.6) | 6 (3.4) | 14 (8.0) | 102 (58.3) | 8 (4.6) | 0 |

[a] based on a 5 point Likert scale anchored at 5 = very beneficial and 1 = very detrimental.

without an undergraduate degree ($p = 0.048$). However, students without an undergraduate degree felt the availability of digital audio files ($p = 0.006$), digital video files ($p = 0.012$), and a student/audience response system ($p = 0.002$) had a more positive impact on their learning. Significantly more P1 students than P2 or P3 students reported that handheld devices were beneficial ($p < 0.001$). The more advanced the students were in the program (P2 and P3), the less beneficial they perceived the impact of instant messaging on learning to be ($p = 0.032$). Although only a small number of all students indicated that video teleconferencing was detrimental, significantly more P1 students than P2 or P3 students gave this response ($p < 0.001$). The availability of digital video files had a more positive impact as students progressed through the program ($p = 0.016$). The P2 students felt student/audience response systems had a more positive impact on learning compared to P1s and P3s ($p = 0.001$). The impact of textbook on learning also declined as students advanced through the program ($p = 0.010$).

Approximately 50% of students indicated that a large amount of technology should be used (eg, all course content is online, computer simulations, streaming video or audio to accompany live lectures) in the classroom. Thirty-eight percent of students preferred classes that used a moderate amount of technology (eg, e-mail, PowerPoint presentations, most course content online). Less than 10% of students preferred classes that only used technology (eg, entirely online with no required face-to-face interactions), classes that used a small amount of technology (eg, e-mail, and limited use of PowerPoint in class, limited course content online), or classes in which no technology was used. There were no significant differences among gender, age group, undergraduate degree, or class status pertaining to preference for the amount of technology used in the classroom.

Finally, 2 opened-ended questions queried students for the technologies that had been most beneficial and most detrimental to their learning in the past 3 months. The most beneficial technologies (cited by at least 10 students) were the availability of digital audio files (38.0%), in-class electronic presentations (30.0%), handheld device (12.0%), course materials posted on Web site (8.0%), and digital video files (6.7%). The most detrimental technologies (cited by at least 10 students) were video teleconferencing in class (27.1%), online testing (17.6%), and audience response systems (16.5%).

## DISCUSSION

The excellent survey response rate was likely due to students being given time in class to complete the survey instrument. Almost 90% of the students who responded expressed overall comfort with technology. Since the inception of the school in 1996, use of educational technology has been emphasized. Students already comfortable with technology may choose to matriculate to the program based on that emphasis. Further evidence of this finding is observed in the comparison of technology comfort level between age, class years, and whether a student earned an undergraduate degree, because there was no significant difference in any of these comparisons.

In this study, male students were more comfortable with technology overall. This finding is consistent with the findings of another study that demonstrated that men rate computer self-efficacy, perceived usefulness, perceived ease of use, and behavioral intention to use e-learning higher than do women.[19]

P1 students used handheld devices more frequently than P2 and P3 students. This reflects a recent change to the University's technology program that only affected the P1 class. Each P1 student was provided with a MacBook Pro laptop and either an iPhone or an iPod Touch. Also, P1 students indicated more frequent use of video-teleconferencing. This is an accurate reflection because only P1 classes were delivered via video-teleconferencing to and from the school's satellite campus.

Approximately 80% of the students indicated accessing course materials 6 or more times each week. Over 90% of respondents felt that the course materials posted on the Web site were beneficial or very beneficial. Course materials for most classes are posted on the school's Web site, which is the key component in our focus on educational technology. The survey responses and open comments related to online course materials revealed that most students use these often and find them beneficial. The results demonstrate that the students view having a single Web-based access point for course material as beneficial. This availability of online course materials may be responsible for the infrequent use of course textbooks that was reported by the students. However, material from the textbooks is frequently incorporated into the online course materials, resulting in indirect student use of the required course textbooks.

The students frequently used the digital video and audio files of the class meetings. Many students provided positive comments related to the availability and benefit of these files. Other studies have reported that the availability of these files may or may not result in decreased class attendance.[20-22] We have not formally studied the impact of these technologies on class attendance, but a notable decline in attendance has not been observed. The majority of student comments regarding the availability of video and audio files were positive as highlighted by the following quote: "The most beneficial element has been the audio recordings on iTunes U. It is nice to be able to access a class at home to be able to get clarifications or take additional notes." Based on the survey responses and comments, these technologies are beneficial to augmenting students' in-class learning.

Many students feel strongly about the benefits of online testing. Over 75% of respondents felt that online testing was beneficial or very beneficial because feedback on examination items and examination scores are accessible immediately after examination completion and submission. However, some students also feel strongly about the detriments of online testing. When a technology problem is encountered with online examinations, it leads to increased stress for students and faculty and staff members. For example, the school experienced a widespread power outage during a final examination that led to failure of our online testing system. More commonly experienced technology-related difficulties include student inability to access examinations because of hardware or software problems and problems with network connectivity. These reliability issues may explain why almost 18% of the students felt that online testing was the single most detrimental educational technology.

The technology most frequently cited as "most detrimental to your learning" was video-teleconferencing. This technology was used only for P1 courses and was cited by 60% of P1 students as the single most detrimental technology. While these results are likely due to various factors including technical difficulties, even when lecture transmission quality is satisfactory, students prefer in-person class activities to video-teleconferencing.

The survey responses related to student/audience response systems should be interpreted with caution. The majority of professional classes do not require attendance, although some courses do and used this system to record student attendance. Students commented that this took time out of class and that this use of the technology was not the intended purpose. This information helps to explain why some students felt that student/audience response systems were the single most detrimental educational technology. If these devices were used for their intended purpose of engaging students in course content, the results may have been different.

A limitation of our study is a lack of educational outcomes related to the technologies. Many of these technologies have been used for quite some time at the school, but there was no baseline assessment conducted prior to their implementation for comparison. Future studies will evaluate outcomes data to see whether the student perceptions in this study correlate with educational outcomes. Another limitation is that the study was conducted in a single school of pharmacy with a focus on technology. Additionally, the survey data were self-reported and may only represent a snapshot of student experiences and perceptions, which could vary over time.

Based on the findings of this study and the school's experience with the incorporation of technology for educational purposes, the following guidelines should be considered when prioritizing resources for current technology to enhance student learning. The key component or core of technology for enhancing student learning is the availability of a single, Web-based access point for students to obtain electronic course materials. Students frequently used and positively evaluated the impact of posted course materials such as syllabi, schedules, policies and procedures, and in-class electronic presentations. Part of this core technology also would require students to have a standardized or university-provided computer, and the portability of a laptop makes it ideal for student use at home and school. Such a laptop requirement could alleviate the need for a school-based computer laboratory. The requirement of a highly portable handheld computing device also should be considered. These initial technologies require staff members and other support resources for implementation and maintenance. This should be considered in the overall cost of implementation.

After this initial technology infrastructure is established, it becomes easier to add additional technologies as desired. The next level of technology to consider adding is classroom recording via audio or video files for students to access and review because students also frequently used and favorably rated the impact of these technologies. Other technologies such as video-teleconferencing, online testing, and audience response systems should be carefully evaluated for potential risks and benefits on learning.

While this was not directly addressed in the survey, it is also important to train faculty members to use these educational technologies effectively, and to develop policies and procedures that address technology reliability concerns and contingency plans for equipment malfunctions and failures. If technical difficulties are not addressed in an appropriate manner, students may grow to dislike some potentially beneficial technologies.

## CONCLUSION

Students in a PharmD program that frequently uses educational technology used online course materials most frequently. The students felt that the online course materials were the most beneficial educational technology at the school and that video-teleconferencing and online testing were the most detrimental educational technologies. Colleges and schools of pharmacy should consider these findings as they develop an educational technology program.

## REFERENCES

1. Brill JM, Galloway C. Perils and promises: university instructors' integration of technology in classroom-based practices. *Br J Educ Technol.* 2007;38(1):95-105.
2. Brazeau GA. Teaching, practice and technology. *Am J Pharm Educ.* 2007;71(3):Article 57.
3. Sanders R. The "imponderable bloom": reconsidering the role of technology in education. *Innovate.* 2006;2(6). http://innovateonline.info/pdf/vol2_issue6/The__Imponderable_Bloom_-__Reconsidering_the_Role_of_Technology_in_Education.pdf. Accessed May, 10, 2011.
4. Ehrmann SC. Beyond computer literacy: implications of technology for the content of a college education. *Liberal Educ.* 2004;90(4):6-13.
5. DiPiro JT. Balancing technology with personal interaction in pharmacy education. *Am J Pharm Educ.* 2002;66(4):440-442.
6. Kuh GD, Hu S. The relationship between computer and information technology use, selected learning and personal development outcomes, and other college experiences. *J Coll Stud Dev.* 2001;42(3):217-232.
7. Lenz TL, Monaghan MS, Wilson AF, Tilleman JA, Jones RM, Hayes MM. Using performance-based assessments to evaluate parity between a campus and distance education pathway. *Am J Pharm Educ.* 2006;70(4):Article 90.
8. Kidd RS, Stamatakis MK. Comparison of students' performance and satisfaction of a clinical pharmacokinetics course delivered live and by interactive videoconferencing. *Am J Pharm Educ.* 2006;70(1): Article 10.
9. Brennan Congdon H, Nutter DA, Charneski L, Butko P. Impact of hybrid delivery of education on student academic performance and the student experience. *Am J Pharm Educ.* 2009;73(7):Article 121.
10. McKay A. Anatomy of a pharmacy school startup: part 1. *J Pharm Teach.* 2003;10(1):31-80.
11. McKay A, Stull R. Anatomy of a pharmacy school startup: part 2. *J Pharm Teach.* 2004;11(1):57-160.
12. McKay A, Stull R, Robinson E. Anatomy of a pharmacy school startup: part 3. *J Pharm Teach.* 2005;11(2):65-114.
13. Willcockson IU, Phelps CL. Keeping learning central: a model for implementing emerging technologies. *Med Educ Online.* 2010;15(0):4275.
14. Rovai AP, Wighting MJ, Baker JD, Grooms LD. Development of an instrument to measure perceived cognitive, affective, and psychomotor learning in traditional and virtual classroom higher education settings. *Internet and Higher Educ.* 2009;12(1):7-13.
15. Tang TL, Austin MJ. Student's perceptions of teaching technologies, application of technologies, and academic performance. *Comput Educ.* 2009;53(4):1241-1255.
16. Kincaid JP, Braby R, Mears J. Electronic authoring and delivery of technical information. *J Instr Dev.* 1988;11(2):8-13.
17. Schmitt N. Uses and abuses of coefficient alpha. *Psychol Assess.* 1996;8(4):350-353.
18. Speedie SM. Reliability: the accuracy of a test. *Am J Pharm Educ.* 1985;49(4):76-79.
19. Ong C-S, Lai J-Y. Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Comput in Hum Behav.* 2006;22(5):816-829.
20. Bollmeier SG, Wenger PJ, Fornash AB. Impact of online lecture-capture on student outcomes in a therapeutic course. *Am J Pharm Educ.* 2010;74(7):2-6.
21. von Kosky BR, Ivins J, Gribble SJ. Lecture attendance and web based lecture technologies: a comparison of student perceptions and usage patterns. *Australasian J Educ Technol.* 2009;25(4): 581-595.
22. Traphagan T, Kucsera JV, Kishi K. Impact of class lecture webcasting on attendance and learning. *Educ Tech Research Dev.* 2010;58(1):19-37.