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INSTRUCTIONAL DESIGN AND ASSESSMENT

Development and Assessment of an Online Elective Toxicology Course

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Objectives. *Introduction to Toxicology*, an elective course for honors pharmacy students and a required course for forensic chemistry majors at The University of Mississippi, has been offered intermittently since 1975.

Design. In order to increase the options available to students, this course was developed and delivered via an online format for 2 semesters. An expanded course evaluation (exceeding the University's standard) was developed to assess student attitudes and perceptions of the online version of the course, along with perceived comparisons between online and traditional environments.

Assessment. Students perceived working at a time of their own choosing as the primary advantage of the online format, yet they perceived managing that time and "keeping up" as being difficult. All respondents perceived that the online course covered the same amount of material as this course would have covered if delivered in the "traditional" format.

Conclusions. Ideas for delivery improvement could be interpreted from student feedback. Data will be used to guide improvements in future offerings of the course.

Keywords: Online learning, toxicology, course evaluation

INTRODUCTION

Independent study has often been accomplished through the "correspondence course" method, which traditionally consisted of the students purchasing a textbook, reading it at a self-determined pace, and taking periodic examinations through the mail. This independent learning has offered flexibility for students and has generally enabled learning that is timed to suit each individual's schedule.

If any communication occurred with the instructor of a correspondence course via mail, it was most often asynchronous, and could actually involve days of lag time between a mailed question from the student and a mailed response from the instructor. Another aspect of the mail correspondence course that could be perceived as "needing improvement" is the dependence on reading and writing as the sole learning methods, methods that are not necessarily effective for students with different learning styles. Occasionally, mailed correspondence courses in the past included audiotapes of lectures. Also, educational television and radio have been employed to deliver courses.[1] However, correspondence students rarely had the opportunity to interact with the information, the instructor, or each other. Newer technologies, such as videoconferencing and the World Wide Web, have made many changes possible and enhanced the potential for constructing more effective learning by introducing multimedia interaction and synchronous communication.[2]

Many universities use online course delivery for those students choosing to meet course requirements through independent study or distance learning. Perhaps the primary advantage of online delivery to the student is convenience. However, if the instructor takes advantage of the multimedia options possible through a web-based course (such as streaming video, PowerPoint presentations with voiceovers, graphics and animation, interactive quizzes, etc), an additional advantage of online instruction is the potential to appeal to students with a wider variety of learning styles.

Student outcomes in online and traditionally delivered courses in higher education have been compared from the perspective of scholastic performance and student satisfaction.[3-8] Studies comparing online delivery with traditional delivery of the same course material have revealed that student performance (as determined by examination scores) does not differ significantly[3,5,7] and at times has even been found to be better in the online group.[4,8] However, student satisfaction with online courses varies,[7] as one might expect.

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The logistics of an online course create other potential challenges to the success of this method of course delivery. The instructor's opportunity to formatively interpret student responses and intervene may be hindered. Authentication of student work also may be an issue.[9] Perceived access to the instructor 24 hours a day, 7 days a week can result in the instructor receiving excessive e-mail and students having unrealistic expectations regarding the instructor's response time. However, despite these and other challenges, the potential for enhanced learning among motivated students choosing the independent study option may outweigh the energy required to overcome the challenges.

The purpose of this research is to examine student perceptions of an online toxicology course delivered at The University of Mississippi. Through an expanded evaluation of the course at the conclusion of the semester, student feedback regarding attitudes and learner characteristics has enabled continued improvement of the course, and enhanced its effectiveness for those choosing to learn independently in the online environment.

COURSE DESIGN

Introduction to Toxicology (PHCL381) historically has been offered in a traditional classroom format at The University of Mississippi. During the academic year 2002–2003 this course was also developed and taught as an online course. Ole Miss Online is a Web-based curriculum supported by The University of Mississippi Department of Outreach and Continuing Education. The courses offered through this online curriculum, which is relatively new to the University, are asynchronous courses that last one semester. *Introduction to Toxicology* was administered through the existing Ole Miss Online structure (using a *Blackboard* platform). The entry portal into the course contained tabs on the left margin that allowed the students to navigate between the announcements, syllabus, faculty information, lectures, course documents, assignments, communication, discussion board, and grade areas of the course.

The course is an approved elective in the pharmacy curriculum and is required of the forensic chemistry majors at The University of Mississippi. Thus, students who typically enroll in this course are "honors" pharmacy students and undergraduate forensic chemistry majors. There are only a few students in each group, so the potential number of enrollees per semester is limited. Recently the office of continuing education received approval for the course as continuing education credit for secondary school teachers, so in the future, enrollment may expand.

The catalog entry for *Introduction to Toxicology* describes the course as an introduction to the "biological and chemical factors which influence toxicity. Review of various classes of compounds of industrial, agricultural, therapeutic and economic importance. Emphasis on the forensic implications of poisoning by these agents." The prerequisites for the course include undergraduate organic chemistry lecture and laboratory. Because the course is a requirement for some students, the instructor made a significant effort to make the online course equal to the traditional format in terms of level of difficulty and content coverage. Therefore, the syllabus (Appendix 1) was the same for both courses, with the exception of a field trip to the state crime laboratory (that was part of the traditional course).

For the online course, the syllabus was divided into a weekly format that coincided with the academic semester. Weekly homework assignments (typically 3 or 4 essay questions) were submitted via e-mail; these were graded to assess students' understanding and to ensure that they were keeping up appropriately. Because all lectures and assignments for the semester were available well in advance, students had the freedom to work ahead of schedule if they so desired. Student assessment consisted of the following: homework (10%), 2 midterm examinations (25% each), a final examination (30%), and a class presentation (10%). There was 1 office hour each week during which students could call the instructor, e-mail, or stop by for help; however, most students just sent e-mail spontaneously as questions arose. Before each examination, there was an optional face-to-face review session, in which students were provided a short recap of the information and could ask questions. Examinations were designed to take 50 minutes (3 hours for the final) to complete, and were administered simultaneously in a classroom and proctored by the professor.

The course was divided into 2 blocks, each using a different textbook. The first half of the course (Weeks 1–8) introduced the basic concepts and principles of toxicology and used *A Textbook of Modern Toxicology*.[10] The second half of the course was more focused on aspects of forensic toxicology including the signs, symptoms, toxicities, and analytical detection methods associated with drugs of abuse (Weeks 9–16). The textbook used for this section was *Principles of Forensic Toxicology*.[11] In addition to the texts, viewing a Public Broadcasting Service (PBS) video of *Frontline* and reading several articles available on the Internet were also required. Each week the students were responsible for viewing 2 or 3 PowerPoint presentations that supplemented their assigned text reading. Voice audio was

recorded for additional explanation for each slide, making the audio for each PowerPoint "lecture" total from 16 to 72 minutes, depending on the topic (typical length was 30–40 minutes). Material for the lecture slides was drawn from the texts[10-11] and from Web sites, including those from the National Institutes of Health and the Drug Enforcement Administration (example sites[12-13]). A "speaker" symbol in the top right corner on each slide prompted students to "click" with a mouse to hear the prerecorded lecture content describing the slide being viewed. In the second part of the class, in which drug categories were discussed, the lectures addressed use, mechanism of action, toxicity, pharmacokinetics, chemical analysis, and drug recognition evaluation.

At the end of the course, the students were asked to prepare a 15-minute PowerPoint presentation, selecting the topic from an appropriate journal or text. Journals included *Clinical Toxicology, Environmental Health Perspectives* (Grand Rounds Section), *Journal of Forensic Sciences* (Case Reports), and *Forensic Science International*. The paper was to describe a poisoning, drug overdose, or drug interaction, and the human toxicity associated with it. Their presentations included background information and symptoms so that their classmates might guess what was wrong with the patient. Once the cause was revealed, the reasons for the diagnosis were provided, including the analytical techniques that were used. Then the students were asked to put the cause in context (for example, were there certain conditions that made this person susceptible? Was it an age- or gender-related event? Is this a rare or potentially common occurrence?). Then they described and justified the therapy that was or should have been attempted, including issues relevant to those that they had learned in the course. Students met in person during the last week of the semester to give their presentations to their classmates. At this final class meeting, the expanded course evaluation was also administered (see below).

COURSE EVALUATIONS

The standard course evaluations administered in all classes at The University of Mississippi were administered for this web-based class in an electronic format via Ole Miss Online. The contents of this standard evaluation form included basic questions, such as "Was the instructor well-organized and prepared for the class session?" and "Which best describes the instructor's attitude toward the subject matter?" These standard items were included in the course evaluations for courses delivered in the traditional format, including this same course (PHCL381) in Fall 2001, when it was structured as a traditional lecture course.

While classes administered by distance education or online environments are comparable in many ways to those administered traditionally, student perceptions vary.[7] The course evaluation prepared by the University (as administered through Ole Miss Online) used questions related to these differences. Items included, "The same amount of material was covered in this class as in a traditional class," and "It is more difficult to keep up in an online class than in a traditional class."

Online learning is considered to be a student-centered approach to the instructional process. As such, the extent to which an online course results in a rich and successful learning experience is largely dependent upon the students' perceptions of that course. An understanding of those student perceptions related to the online environment (especially preferences for some aspects of that environment) can serve to enhance an understanding of the impact of learning in this format.[6] Other aspects of the course that should be evaluated include how well the course facilitates the stated outcomes, creates a "viable and rich learning environment," provides mechanisms for interaction, and includes relevant resources and activities.[14] Some items pertaining directly to the online course environment as administered through Ole Miss Online included such items as "The material for this course was adapted appropriately for the online format," and "Use of online technology enhanced the teaching/learning process."

An expanded course evaluation questionnaire was developed by the authors to examine additional perceptions and to facilitate improvement in the course for subsequent offerings.

DATA COLLECTION AND ANALYSIS

The standard University course evaluations for this web-based course were administered Ole Miss Online as described above during both semesters under study. Students could electronically select any one of multiple choices for each item, organized through the "assessment" features built into the *Blackboard* learning platform. Students were required to log in to complete the survey, and while aggregate results were provided to the instructor after the completion of the semester, individual responses were anonymous.

The expanded course evaluation questionnaires were administered on paper during the last class period of the 2 semesters under study, and students were required to attend those sessions on campus. Questionnaires were distributed by one of the class enrollees acting as monitor (as is done in other course evaluations conducted by

Table 1. Number of Students Using Course Resources (Fall 2002 and Spring 2003)

Course Resource	Fall 2002(n = 3)	Spring 2003(n = 8)	Total(n = 11)
PowerPoint slides for lectures on Blackboard	3	8	11
Voice-over audio for the PowerPoint lectures on Blackboard	3	7	10
PowerPoint slides for lectures on CD-ROM	3	2	5
Voice-over audio for the PowerPoint lectures on CD-ROM	3	1	4
Assigned articles available on Blackboard	3	7	10
Face-to-face review sessions	3	4	7

the University), and were returned in an envelope by the monitoring student to the departmental secretary. They remained sealed in the departmental office until the beginning of the next semester, when they were returned to the course director.

Participation was not mandatory or required for grade release; therefore, not all students who enrolled in the course for these semesters actually completed the evaluations. For the standard evaluation items (administered electronically) 2 students (50%) participated in fall 2002, and 5 students (63%) in spring 2003. The response rate for the expanded evaluation designed specifically for this course (administered on paper) was higher, with 3 students (75%) participating in fall 2002 and 8 students (100%) participating in spring 2003. Data were analyzed using the *Statistical Package for the Social Sciences (SPSS)*, version 10.0 (SPSS, Inc, Chicago, Ill; 2000). As the online course was identical for both semesters, and the numbers of students per semester were so small, student data from both semesters were grouped for most analyses.

RESULTS

User Statistics

Of the 11 students (3 in the fall semester and 8 in the spring semester) who provided their feedback on the expanded evaluation form, the majority (64%) accessed the course resources primarily through an Ethernet or LAN (Local Area Network) connection on campus. Such high-speed Internet connections are readily available in dormitories, pharmacy classrooms, and throughout the University library system. The remaining students accessed the course most frequently from home, using a 56.6 Kb modem (27%) or cable modem (9%).

Students were asked to provide an estimate that best described the frequency of their access to course materials online throughout the semester. Most (73%) accessed course resources multiple times per week, but less than once per day. Some (18%) were able to get by with accessing the information once per week or less (recall that weekly assignments were required), while one student in the spring semester actually indicated that they accessed the course several times daily.

An average of 3.3 hours per week was devoted to the class (including time spent reading, viewing lectures, doing homework, studying, etc). If the course were administered in a traditional lecture format, 2.5 hours of class time would be expected (three 50-minute sessions); reading and homework would occur outside of that time. Therefore, the average time reported by these online students seems reasonable in comparison with the average time spent by students attending class. However, the average does mask the extremes. In reality, 18% of these online students spent only 1.5 hours per week on the course, and another 18% spent 5 or more hours per week. These data indicate that the online format may have provided "efficiency" for some; but for others, the online delivery required a time commitment greater than expected.

All students responding to the standard University course evaluation posted online through *Blackboard* (2 in the fall semester and 5 in the spring semester) indicated that this was the first online course that they had taken. All indicated that they had adequate technical support when requested while taking this class. All of the responding spring-semester students considered themselves "traditional" students (full-time). Forty percent of those chose to take the class online because they could work at their own pace; 20% found it more compatible with their schedules, and another 20% took it online only because it was not offered in a traditional setting. (Fall students were not asked about their student status or the reasons for taking the course online.)

Resources Utilized

This online course included a variety of resources to aid the students' learning. All students indicated that they purchased the 2 textbooks that were recommended. All students also viewed a *Frontline* episode on endocrine disruption that had been linked from the Internet. However, student use of the other course resources varied (See Table 1).

In Table 1, all 3 responding students from the fall semester indicated use of every one of the resources

Table 2. Student Perceptions of the Online Course

Attitudinal Statement	Mean (SD)	Mode	Min-Max
The material for this course was adapted appropriately for the online format.*	1.9 (1.5)	1	1-5
Use of technology enhanced the teaching/learning process.*	3.1 (1.4)	3	1-5
The voice-overs were important to my learning from the Powerpoint lectures available online.	1.9 (0.8)	1	1-3
I consistently listened to the entire voiceovers for the Powerpoint lectures available online.	3.0 (1.2)	2	2-5
I found the face-to-face review sessions to be very helpful for this course.†	1.9 (1.0)	2	1-4
Face-to-face review sessions were not essential to my learning for this course.	3.1 (1.5)	4	1-5
I would like to have additional opportunities to discuss topics online through chat sessions with other students in the class or with the instructor.	3.0 (1.0)	3	1-4
The online video content for this course was easy to view from my computer.	2.9 (1.6)	2	1-5
I used Blackboard far more often than CD-ROM for accessing the materials for this course.	2.0 (1.4)	1	1-5
I frequently had difficulty accessing the online resources for this course.	3.9 (1.3)	4	1-5
I preferred viewing the course content on CD, rather than accessing it online.†	3.4 (1.8)	5	1-5
I saved time by taking this course online (vs. the face-to-face option).	1.8 (1.1)	1	1-4
The time involved for this online course was about what I expected.	2.3 (0.9)	2	1-4
It was difficult to manage my time for this class.	3.1 (1.4)	2	1-5
I was required by the course structure/class schedule to keep up from week to week.	1.9 (0.7)	2	1-3
I kept up well with this course throughout the semester.	2.6 (1.3)	2	1-5
I consider myself to be technologically proficient.‡	1.8 (0.6)	2	1-3
I enjoy being an independent learner.	1.8 (1.0)	1	1-4
It is important to me to feel like I am part of a class.	3.3 (1.2)	3	1-5
I enjoyed this online course.*	2.0 (1.2)	1	1-4
I would like to take more classes in the online format.*	2.6 (1.3)	2	1-5
I will recommend online classes to my friends.*	2.4 (1.0)	2	1-4

* These items came from the standard University evaluation (n = 7). All other items were from expanded evaluation (n = 11, except where noted).

† n = 8, with three respondents choosing "N/A"

‡ n = 10, with one respondent choosing "N/A"

Responses are based on a 5-point Likert-type scale, where 1 = "Strongly Agree" and 5 = "Strongly Disagree."

available to them. However, resource use by students enrolled in the spring semester was not as consistent. Not enough is known about the students themselves to provide insight regarding this difference. However, the proportions of pharmacy honors students were different in the 2 semesters: 50% (2 of 4) of the enrollees in fall 2002 were in the honors group; whereas only 8% (1 of 12) of the spring 2003 class claimed that status.

The CD-ROM mentioned in Table 1 contained static copies of the same PowerPoint lectures distributed via *Blackboard* online, and was created to facilitate student access in case of difficulty downloading the graphics and audio voiceovers online. Of interest is the limited use in the spring semester of this CD-ROM. Few students actually came by the course director's office to retrieve the CD-ROM in the spring semester. Given that most of the spring students were off campus and many accessed course materials primarily from a modem, the CD could have reduced any frustration and time loss that they might have experienced downloading files from the Internet.

Perceptions of the Online Course

Both the standard and expanded evaluations included attitudinal items measuring student perceptions. Respondents indicated agreement with these attitudinal statements on a 5-point Likert-type scale. Attitudinal results related to students' perceptions of the online course itself are depicted in Table 2, grouped according to attitudes toward the resources, access issues, and time management, and general attitudes toward the online environment.

Student perceptions regarding course resources may be used to guide modification of those resources in future iterations of the course. Responses regarding voiceovers were generally positive, indicating that element of the material was used in their learning. One student did not indicate use of voiceovers at all; however, as evaluations were not linked to identifiers or grades, whether this student performed well in the class without the information provided in the voiceover content is not known. How much the others used the voiceovers for

Table 3. Student Perceptions of Online Course Relative to Traditional Delivery

Attitudinal Statement	Mean (SD)	Mode	Min-Max
The same amount of material was covered in this class as in a traditional class.	1.7 (0.5)	2	1-2
It is more difficult to keep up in an online class than in a traditional class.	2.6 (1.4)	2	1-5
I had as much interaction with my instructor as I would have in a traditional class.	3.7 (1.0)	4	2-5
I did not ask as many questions as I would have in a traditional class.	2.3 (1.4)	1	1-4
I did not participate in discussion as much as I would have in a traditional class.	2.9 (1.2)	4	1-4
I would have learned more in a traditional class.	2.7 (1.7)	1	1-5
I would have had a better grade in a traditional class.	2.7 (1.7)	1	1-5
I saved time by taking this course online (vs. the face-to-face option).*	1.8 (1.1)	1	1-4

their learning is still in question because few were willing to strongly agree that they listened consistently to entire voiceovers for the sessions.

The potential advantage of face-to-face review sessions held by the course director before examinations was not used by all students. Only 7 of the 11 students participating in the survey actually attended the review sessions. (However, all 11 participants provided feedback on how "essential" the review sessions were; the impressions from the 4 nonattendees may be negatively biased, to affirm their choice not to take advantage of that face-to-face learning resource.) Students were also relatively neutral (mean response = 3.0 ± 1.0) to opportunities other than face-to-face sessions for discussion of course topics with the instructor or with other students. This "independence" in learning is supported by the general agreement with the statement, "I enjoy being an independent learner" (mean = 1.8 ± 1.0).

Regarding access, student responses spanned the widest range possible (1 to 5), suggesting that access to course materials may have been difficult for some, or at least less convenient than expected. For the video content in particular, 3 students responded with a 5 indicating they strongly disagreed. All 3 used modem connections (2 dial-up and 1 cable modem). While the online video segments were presented in segments no longer than 15 minutes each, streaming was required and could have been hindered by slower connections. No data were gathered regarding the amount of video that was watched; however, essay assignments suggested that they had seen the video in its entirety. For those who had difficulty with watching video content online, a videotape of the episode was available from the instructor and additional time was provided for those students to complete their essays.

The means for the 2 semesters varied noticeably for the item, "I preferred viewing the course content on CD, rather than accessing it online." The average response for the fall cohort was 2.3 ± 1.5; whereas for the spring group, the average was 4.0 ± 1.7. A similar discrepancy is noted for the item, "I used *Blackboard* far more often than CD-ROM for accessing the materials for this course;" the mean for students in the fall class was 3.3 ± 1.5, and that for the spring class was 1.5 ± 1.1. Some of this trend may be related to the fact that so few students in the spring made the effort to retrieve this offline resource, while all fall semester students obtained a copy of the CD resources.

Most students (72%) believed that they saved time by taking this course online (responding with a 1 or a 2). Also, the course structure, requiring them to keep a certain weekly pace, may have been a positive factor for student learning because most agreed with the statement, "I was required by the course structure/class schedule to keep up from week to week." However, the responses to the time management item varied widely (SD = 1.4) from "strongly agree" to "strongly disagree," suggesting that some students may have found managing their time more difficult than they had anticipated. Student time investment in the course approximated their expectations, as indicated by the fact that no student strongly disagreed with the statement, "The time involved for this online course was about what I expected." Perhaps the course description and syllabus communicated the course director's expectations well.

Perceived Comparisons Between Online and Traditional Courses

Additional attitudinal items encouraged students to make comparisons between this course in online format and courses that they have taken previously in traditional classroom format. Those comparisons are reported in Table 3.

None of the students perceived that they missed any content by taking the course online; all were in agreement with the statement, "The same amount of material was covered in this class as in a traditional class." Student participation and interaction with the instructor were perceived to be less in the online environment (as interpreted from responses to the items comparing inter-

action with the instructor, quantity of questions asked, and participation in discussion). However, students were divided in their perceptions that they fared worse for having taken the course online (mean = 2.7 ± 1.7). For the statements, "I would have learned more," and "I would have had a better grade," 3 students agreed, 3 disagreed, and 1 was neutral.

As mentioned previously, several of the standard evaluation items that were present for the online course were also present on the course evaluation in fall 2001, when the course was offered in the traditional classroom setting. The results of the online students (fall 2002 and spring 2003) were examined in comparison with those of the traditional students (fall 2001). Although the number of responses in each group prevents the drawing of any absolute conclusions, for the 7 items that the evaluations had in common, student responses were favorable and similar. Those items included evaluations of the instructor's preparation for class sessions, enthusiasm for subject matter, appropriateness of examinations, difficulty of the course, overall performance of the instructor, and other general items.

Additional Student Comments

Students were provided an opportunity to share feedback through open-ended questions on the evaluation forms. This qualitative data provided additional information about student attitudes toward the course. When asked about their "favorite aspect" of the online environment, several students responded with comments related to the convenience of it, or the advantage of being able to do their coursework from home:

- "Timing! I loved that I could work when it was convenient for me."
- "Easy to use; convenient to schedule."
- "The freedom to attend class at awkward times like midnight or later."
- "I liked being able to sit at home and complete my assignments at my convenience."

However, one student had no "favorite aspect" and "would have enjoyed a regular class better." That student commented, "You have to be very motivated to take an online class," revealing that the online environment was not ideal for all students who chose to take this course.

Regarding why the students did choose to take the course online instead of face-to-face, most commented that online delivery was the only option for the semester in which they wished to complete the course. Obviously, however, the convenience and independence of an online course does appeal to some learners. One student commented, "I learn better at my own pace. I have a low attention span and find it very helpful that I can walk away from the computer for a while and then come back."

DISCUSSION

Limitations

The small number of students in these 2 semesters limited the analyses that were possible with these data. However, the purpose of the evaluation was fulfilled in that the responses enhanced the course instructor's knowledge of student perceptions regarding this pilot course. This, in turn, will contribute to the improvement of the course in its subsequent iterations.

The number of responses is not the only potential limitation of this evaluation. As with all course evaluations, though anonymity is assured, there may be some social desirability bias in the student responses. Because some of the questions asked pertained to personal characteristics of the students themselves (eg, "I consider myself to be technologically proficient," and "I enjoy being an independent learner"), it is possible that some responses to those items portrayed the image that the student wished to see of himself or herself, rather than an honest reflective response.

"Distance" Learning

While the lecture and reading materials were available for the students online, all the students who have taken the course to date have been full-time students on the Oxford campus. With that in mind the course was not a true distance-learning experience. If in the future students were enrolled from across the state, there are a few aspects of the course that would need to be adjusted accordingly. For example, tests could be taken through the *Blackboard* interface instead of being proctored in person. Also, to maintain the "face to face" real-time nature of the review sessions and student presentations, videoconferences could be established between the main campus and campus branches.

Technology Issues

While there were no specific student comments about the content, ideas for delivery improvement could be interpreted from their feedback. Students with on-campus Ethernet access had an easier time accessing the large lecture and video files. Students did need to have proficiency with the technology and the *Blackboard* interface, as there was no specific training available to them beyond questions they could ask of either the instructor or Ole Miss Online staff.

In the future a better way of recording audio will be pursued. When the lectures were recorded in the

PowerPoint program, the files became extremely large. Furthermore, while none of the students complained, the instructor was not completely satisfied with the quality of the audio. Additionally, the extent to which students listened and their motivations for listening to the audio recording were unclear. It would be helpful to know whether students listened to selected portions that were graphics intensive, but trusted the verbal content on other slides without listening to the voiceovers; if they were skimming; or if they simply ran out of time to listen to the last slides.

The size of the PowerPoint lectures required that they be converted to HTML to be "published" to *Blackboard*. While this allowed for smaller file sizes that could be opened remotely, it complicated course editing and updating. For example, certain current events related to the lectures, such as the lowering of the legal blood alcohol level, were mentioned. While referring to these current events might have been timely during the initial class session, these references could date the presentation in future offerings of the course. Likewise, there might be other events in the future that would add relevance to the course at that time.

Unfortunately, it is not nearly as easy to update or edit the *Blackboard* lectures and republish them as it would be to update presentations in the typical classroom situation. Another technological consideration was related to student e-mails, including questions and homework. The current system at University of Mississippi does not provide instructors with a separate e-mail account for course-related student communication. Therefore, the instructor has to be fairly organized in order not to "lose" a student's e-mail in with all the other e-mail they receive.

Instructor's Impressions

As should be expected, the teacher-student interaction in an online environment is very different when compared with that in a traditional classroom setting. As professors, we become accustomed to contact and feedback, be it quizzical expressions or raised hands. In the online environment, this interaction is missing. Not until the first examination in this course, which was administered in person in a classroom on campus, was the instructor able to put students' names with faces. In a true distance-learning class that connection may not happen at all. All interaction had to initially develop through e-mails between the instructor and the students. One option that will be used to a greater extent in the future sections of this course is the discussion board provided in the *Blackboard* platform. By placing discussion questions up more frequently, student interaction, both between classmates and with the professor, could increase and make students feel more a part of a class.

Finally, even with the help of the Ole Miss Online staff, it took much longer to develop this course than a traditional class. However, a clear advantage of online course development is that once it is done the first time, there is significantly less work to do in subsequent semesters to offer the course again.

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Appendix 1. Course Syllabus.

Week	Class Schedule	Readings*
Week 1	Introduction	MT 1.2
	Dose-Response	MT 2.1-2.8, PFT 4
	Absorption	
Week 2	Distribution/Elimination	MT 2.8-3, 5
	Phase I Metabolism	MT 3.1-3.3
Week 3	Phase II Metabolism	MT 3.3
	Reactive Metabolites	MT4
Week 4	Cancer	MT 8.1-8.2
	Cancer and Teratogens	MT 8.3
	Modification of Metabolism	MT 6
Week 5	Front Line Video	MT 9
	Target Organ Toxicity	
Week 6	Classes of Toxic Chemicals	MT 10.1-10.5
	Catch Up/Review	
Week 7	Exam 1 (Covers Materials from Weeks 1-5)	MT 10.5
	Pesticides	
Week 8	Toxicity Testing/Risk Assessment	MT 11
Week 9	History of Poisoning	Online reading
	Forensic Drug Testing	PFT 3
Week 10	Analytical Methods Review	PFT 5-9
Week 11	Alcohol	PFT 10
	CNS Depressants	PFT 11
Week 12	Opioids	PFT 12
	Cocaine	PFT 13
	Exam 2 (Covers Materials from Weeks 6 - 11)	
Week 13	Marijuana	PFT 14
	Amphetamines	PFT 15
Week 14	Hallucinogens	PFT 16
	Antidepressants	PFT 17
Week 15	CO, CN	PFT 18
	Inhalants	PFT 19
	Metals	PFT 20
Week 16	Class Presentations	
Week 17	Final Exam (Cumulative)	

*MT = Modern Toxicology Text, PFT = Principles of Forensic Toxicology Text