INSTRUCTIONAL DESIGN AND ASSESSMENT

Evaluation of Performance and Learning Parity Between Campus-based and Web-based Medicinal Chemistry Courses

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Objectives. To evaluate the performance and learning parity between campus and Web students enrolled in required medicinal chemistry courses.

Methods. The instructors established an activity grid for the 2 courses. Learning objectives were identified for each activity and measurable approaches to their accomplishment were articulated. Formative course evaluations were analyzed for common themes.

Results. The student cohorts performed at comparable levels on examinations and in-class assessments. Significant differences between cohorts were noted on weekly pre-class quiz performance, case presentations, and final grades. No significant relationship was observed between course delivery and letter grade. However, a difference in letter grade distribution was observed between cohorts in both the fall and spring semesters. The educational mentor used in the Web pathway contributed to performance parity for those students. Similar themes were observed upon analysis of the formative course evaluation.

Implications. The instructional methods employed resulted in partial performance parity between campus and Web medicinal chemistry students. Modifications were made to enhance opportunities for both learning and performance parity in subsequent course offerings.

Keywords: Medicinal chemistry, Internet, distance education, educational mentor

INTRODUCTION

Creighton University implemented an entry-level Web-based PharmD degree pathway in 2001.1 Students in the Web pathway are required to take the same courses offered to the on-campus students; however, the Web curriculum has some minor modifications in course sequence to allow for laboratory or practice site-dependent courses, as well as campus-based elective courses, to be taken during the summer when these students are in Omaha.1 Clerkships for Web and campus students are handled in the same way, with Web students being allowed to take clerkships where they reside following a quality-assurance assessment performed by the pharmacy program’s Office of Experiential Education.

One of the major challenges of this unique mode of professional education delivery is the assurance of parity between Web and campus-based courses. During the initial implementation of the pathway, parity was mandated by faculty members and was defined to include course objectives, ability-based outcomes, and student evaluation techniques. Faculty members also agreed that instructional methods could be pathway specific as long as identical learning outcomes were achieved through their use. Learning parity, which includes all aspects of a course offering (eg, content, instructional methods, learning aids and strategies, and instructors’ teaching abilities) is an important aspect of achieving overall performance parity. Faculty members who had been teaching exclusively in didactic courses in a classroom environment were initially uncertain of how to best migrate their courses to the Web environment, but were committed to working together to ensure learning parity between the Web and campus students.

Providing evidence for learning and performance parity should be an explicit expectation of all courses offered in an outcome-based program. Evaluation of all aspects of course delivery, learning strategies, and student performance evaluation should stimulate a dynamic and consistent process improvement to help achieve performance parity for all enrolled students. As more schools, including pharmacy schools, become involved in distance education, evidence of parity will become an important aspect of accreditation.
The Parity Table form required by the School’s curriculum committee was completed to indicate the same course objectives and ABOs for the 2 cohorts (available from the authors). Student-based course evaluation and assessment results are reviewed after each course offering, and an action plan is formulated that will appropriately address real and perceived course deficiencies.

In addition to course objectives and ABOs, the course faculty members established identical student performance evaluation techniques for both classes, which included pre-class assessment quizzes, in-class assessments, case presentations, and examinations. Course content was delivered through detailed Microsoft Word documents or annotated Microsoft PowerPoint presentations. Narrative summaries of all lessons were also provided. Moreover, the instructors evaluated strategies utilized by faculty members who taught in the first didactic year in the Web pathway and adopted those thought to be of value. For example, a newsletter summarizing important course content and key points from campus-based class discussions was sent to both campus and Web students at the end of each week to further ensure parity across the classes (sample newsletters are available from the authors).

### METHODS

#### Instructional Methods

The faculty members teaching in the medicinal chemistry courses agreed upon the instructional methods to be used to accomplish course objectives in both pathways (Table 1). The methods used were essentially consistent across pathways with the exception of the mode of faculty communication with students for case discussion, examination review, and content assistance. Three educational mentors were hired to facilitate the learning of Web students, and were given specific responsibilities to help students successfully accomplish course objectives. The instructors were also involved in online discussions, online group case study presentations, and voluntary pre-examination conferences with Web students.

#### Establishing Parity

As in previous years, the instructors established course objectives and identified the ability-based outcomes (ABOs) to be met by successful completion of the 2 medicinal chemistry courses. The specific ABOs that have been consistently emphasized in these courses include: (1) drug therapy evaluation, (2) pharmaco-therapeutic decision-making, (3) taking personal responsibility for learning, and (4) critical thinking. Special attention was paid to how these objectives and outcomes would be achieved in the Web-based course, and how the educational mentors hired to facilitate Web-based learning could contribute to achieving parity. The course objectives and outcomes selected are consistent with the faculty members’ desire to: (1) integrate course content with material previously learned and that yet to come, (2) reinforce the clinical relevance of drug chemistry, and (3) stress the application of drug chemistry and structure-activity relationships (SAR) to patient care. The instructors have routinely utilized application-based learning tools such as the medicinal chemistry case study and the structurally-based therapeutic evaluation (SBTE) to meet course objectives and outcomes, and these tools can be easily adapted for Web-based delivery.

Once finalized, the course objectives and outcomes were made explicit in the course syllabus, which was identical for both the campus- and Web-based course. The syllabus was shared with students during the first class period (campus) or at the summer course orientation session (Web), and is available from the authors. The Parity Table form required by the School’s curriculum committee was completed to indicate the same course objectives and ABOs for the 2 cohorts (available from the authors). Student-based course evaluation and assessment results are reviewed after each course offering, and an action plan is formulated that will appropriately address real and perceived course deficiencies.

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A major method used to ensure parity was the establishment of a course activity grid. Course activities for both semesters were listed, goals for each activity were identified and linked to course objectives and ABOs, instructional methods and the responsibilities of students and mentors were made explicit, and all actions needed to accomplish each activity were specified for both the campus and Web students. To be implemented, activities had to be accomplishable by both cohorts.

Measuring Performance Parity

The 4 activities utilized in 2002-2003 to measure student performance parity included pre-class assessment quizzes, case presentations, in-class assessment of content understanding, and examinations. In the academic year 2003-2004, parity was based on student performance on pre-class assessment quizzes and examinations. The quizzes, given weekly throughout the academic year, were short, objective question-based exercises designed to introduce students to the topics and reward them for reading course lessons prior to class (Appendix 1). The average of all quizzes given during the semester comprised 10% of the course grade. Campus and Web students were divided by faculty members into groups of 4 or 5 for case study work. In 2002-2003 campus student groups were responsible for formally presenting 1 pre-assigned case study during class time (25 minutes), while Web student groups posted a PowerPoint presentation on their case, and then facilitated discussion with classmates via the course discussion board for 1 week (available from authors). Student groups presented only once during the academic year, and the presentation was worth 5% of the course grade during the semester in which the student presented. The in-class assessments administered in the 2002-2003 academic year were 2 short case studies per semester designed to assess student understanding of key course concepts and critical thinking skills (copies of case studies used are available from the authors). This learning assessment tool was utilized both semesters and was worth 5% of the course grade. Examinations consisted of a combination of objective and subjective questions, and always included at least one clinical case study and a few short answer/essay questions. The average of 4 examinations was worth 80% of the course grade in 2002-2003 and 90% in 2003-2004.

Educational Mentor and Parity

Creighton University hires educational mentors to facilitate the learning of the Web students. In preparation for hiring a mentor, faculty members complete a mentor specification form that clearly identifies the qualifications and role of the mentor in their course(s). In addition to completing this form, the Chemical Basis faculty members identified the facilitative role of their educational mentors for each course activity (see Appendix 2 and Table 2). Faculty members clarified mentor responsibilities during separate orientation sessions for mentors (telephone) and students (on campus), and through posting on the course Web site. Mentor evaluation forms were developed and utilized to assess how well the mentors assisted Web students in meeting course objectives, and in helping faculty members assure performance parity.

Summative Course Evaluation

Student responses to summative course and instructor evaluation questions provided an indirect measure of parity between the 2 student groups. Common and disparate themes were identified by the course faculty members and mentors, and used to make course modifications to enhance learning and performance parity (Tables 2, 3, 4, and 5).
RESULTS

Performance Parity

In 2002-2003, student learning was evaluated based on performance on in-class assessments, pre-class assessment quizzes, case presentations, and examinations. The cohorts under study performed at a comparable level on examinations and in-class assessments administered during the fall and spring semesters (Table 6). However, significant differences were observed in the class averages for both the open book pre-class assessment quizzes (fall, \( p < 0.001 \); spring, \( p < 0.05 \)) and case presentations (\( p < 0.001 \)).

Significant differences (\( p < 0.05 \)) were also noted between final course grades for cohorts in the fall 2002, from which letter grades were assigned (Table 6).

Table 4. Narrative Comments by Campus and Web Students on Enhancing the Learning Environment (Spring 2003)

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<thead>
<tr>
<th>Evaluation Item</th>
<th>More lecture</th>
<th>Lecture audio taped</th>
<th>Continuity between instructors</th>
<th>Continuity between instructors</th>
<th>Align with pharmacology</th>
<th>Align with pharmacology</th>
<th>Slower pace</th>
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<th>Reduce work, increase number of credit</th>
<th>Reduce work, increase number of credit</th>
<th>Uniform/consistent format for notes</th>
<th>Notes in a uniform consistent format, easy to print</th>
<th>Shorter examinations, make less difficult</th>
<th>Shorter examinations, make less difficult</th>
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Table 5. Campus and Web Students’ Evaluation of Instructor Effectiveness (Spring 2003)

<table>
<thead>
<tr>
<th>Evaluation Item</th>
<th>Strongly Agree – Agree, %</th>
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<tbody>
<tr>
<td></td>
<td>Campus Students (n= 97)</td>
</tr>
<tr>
<td>Verbal presentations clear</td>
<td>90</td>
</tr>
<tr>
<td>Organized course outline</td>
<td>84</td>
</tr>
<tr>
<td>Clear learning objectives</td>
<td>85</td>
</tr>
<tr>
<td>Effective teaching methods</td>
<td>77</td>
</tr>
<tr>
<td>Promoted learning with case-based examples</td>
<td>79</td>
</tr>
<tr>
<td>Incorporated technology appropriately to aid learning</td>
<td>85</td>
</tr>
<tr>
<td>Attitude encouraged learning</td>
<td>72</td>
</tr>
<tr>
<td>Content related to course objectives</td>
<td>88</td>
</tr>
<tr>
<td>Promoted mutual respect</td>
<td>69</td>
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<tr>
<td>Interest in student success</td>
<td>80</td>
</tr>
<tr>
<td>Encouraged discussion</td>
<td>81</td>
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<tr>
<td>Demonstrated professionalism in interactions</td>
<td>69</td>
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<tr>
<td>Help prepare to think as a health care professional</td>
<td>75</td>
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</tbody>
</table>

Table 6. Assessment of Campus and Web Student Learning

<table>
<thead>
<tr>
<th>Evaluation Technique</th>
<th>PHA337, N=104</th>
<th>PHA4447, N=49</th>
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<tbody>
<tr>
<td></td>
<td>Fall 2002</td>
<td>Spring 2003</td>
</tr>
<tr>
<td>Examination</td>
<td>60.4</td>
<td>57.7</td>
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<tr>
<td>Pre-assessment quizzes</td>
<td>9.7</td>
<td>8.3*</td>
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<tr>
<td>Presentation average</td>
<td>4.5</td>
<td>3.9*</td>
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<tr>
<td>Course score</td>
<td>77.8</td>
<td>71.4†</td>
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*significant at \( p < 0.001 \).
†significant at \( p < 0.05 \)

Averages for examinations, in-class assessments, pre-class assessment quizzes, case presentations and Course score are out of 80%, 5%, 10%, 5% and 100%, respectively.

However, when letter grade distribution was examined, Chi square analysis indicated no significant relationship between course delivery method and letter grade. Table 7 does show a difference in the distribution of letter grades between cohorts in the fall 2002 and spring 2003 terms, however. The percentage of students performing at the higher letter grades (A and B+) in the fall, and at the A level in the spring, is higher for the Web student group. Conversely, the campus student group had a higher percentage of failing grades in the fall term, and a higher percentage of C and D grades in the spring term compared to the Web student group. The percentage of A and B grades given was much lower in spring 2003 than in fall 2002 for campus students, while the percentage of C and D grades increased.

For 2003-2004, significant differences (\( p < 0.001 \)) on pre-class assessment quiz scores, examination grades, and course grades were observed in the fall semester between the 2 cohorts, with the on-campus students performing at a higher level (Table 8). In the spring semester, there was no significant difference between the 2
cohorts in performance on examinations and final course scores. However, a significant difference ($p < 0.001$) still existed in performance on pre-class assessment quizzes (Table 8).

Mentor Evaluation

Spring semester responses to mentor, course, and instructor evaluation questions were utilized in the parity analysis because they represented the summative student perception of their experience in the Chemical Basis of Drug Action (medicinal chemistry) courses. The mentor evaluation data from the 2003-2004 academic year (Table 2) show an improvement in how the Web students perceived the facilitative role of the educational mentor. Specifically, student perception about the mentor’s active participation in discussions, encouraging participation during discussions, providing valuable information, being available for assistance, responding promptly to questions, and interacting positively with students almost doubled. Both Web-based classes unanimously affirmed the course mentor’s lack of negative teaching attributes. In addition to the objective evaluation results, narrative responses by both student groups affirmed their appreciation for the dedicated service of their educational mentor.

Summative Course Evaluation

When comparing the course evaluations of the campus and Web students (Table 3), several themes emerged. A similar majority of both cohorts agreed or strongly agreed that the material provided via the course Web page aided learning (88% vs 91%), that the content was related to course objectives (84% vs 87%), and that the examinations reflected the expected level of difficulty (62% vs 64%). A higher percentage of Web students than campus students thought the material was presented at a reasonable rate (65% vs 57%), that the required textbook effectively aided learning (32% vs 23%), and that the Chemical Basis courses were difficult (84% vs 72%).

Constructive changes suggested by campus and Web students for enhancing the learning environment are summarized in Table 4. While several general themes that were consistent between cohorts emerged, campus students appeared more concerned about continuity between instructors while Web students asked for quicker turnaround time for the return of graded examinations and for notes to be available on the Web in an easy to print format.

Instructor Evaluation

Table 5 presents the perception of both student cohorts in the spring of 2003 about 1 of the course instructors. The data show that, based on this evaluation, the 2 student cohorts have similar perceptions about the organization and clarity of information contained in the course syllabus and handouts, and about the instructor’s teaching effectiveness and attitude. Differences existed in student perception on the clarity of verbal presentations, the effectiveness of case-based examples in promoting learning, the appropriate incorporation of technology to aid learning, and the success with which the faculty prepared them to think as health care professionals.

DISCUSSION

Performance Parity

There was no significant difference between Web and campus student cohorts in performance on in-class assessments and examinations in the fall and spring semesters of 2002-2003 (Table 6). This is important to learning parity since both test overall student understanding of key concepts. As the examinations are worth 80% of the final course grade, and since this evaluation technique is measuring students’ ability to meet course...
The percentage of students earning specific letter grades was different for the campus and Web cohorts in both fall and spring semesters. The percentage of Web students who performed at an 'A' level was higher than that for campus students, particularly in the spring semester. This indicates that once the Web students understood what was required for success in the Chemical Basis courses, they were able to perform. The percentage of Web students at the C+ level in the spring term is higher than the percentage of campus students at this grade level, and reflects the significantly lower number of Web students at average (C) and below average (D) grade levels in that semester. However, despite the significant difference between groups in final course scores, there was no significant correlation between course delivery and letter grade, indicating that students in both pathways had a similar chance of obtaining a particular letter grade.

There was great consistency between fall and spring terms in the percentages of Web students earning above average (A, B+, and B), average (C and C+), and below average (D and F) course grades. Specifically, for the fall and spring semesters, the percentages of Web students earning above average grades were 45% and 44% respectively; the percentages earning average grades were 39% and 40%, respectively; and those earning below average were 15% and 16%, respectively. For the fall and spring semesters, the percentages of campus students who earned above average grades were 45% and 31%, respectively; the percentages who earned average grades were 34% and 41%, respectively; and the percentages earning below average were 22% and 28%, respectively. There are a number of factors that may have contributed to the variation in performance in the fall and spring semesters by the campus cohort. A higher percentage of campus students took advantage of an optional extra credit opportunity offered only in the fall (41% of campus students vs 18% of Web students). The points earned were sufficient to shift 15 (14%) of the 104 campus students who completed the extra credit project to a higher final fall course grade, while only 3 (1.5%) of the 49 Web students completing the extra credit project were boosted to the next higher grade level. As the extra credit option was not offered in the spring term, the campus students’ final grades in that semester may have suffered to a greater extent than the Web students’ grades.

While accurately quantifying the amount of effort Web students gave to the Chemical Basis courses is difficult, one measure of campus students’ effort is class attendance. The instructors noted a significant drop in class attendance as the academic year progressed. Absenteeism was particularly severe in the last 2 months of the spring semester. We hypothesize that the low attendance rate and lack of participation in in-class active-learning activities had a profound negative impact on the composite course grades of the campus students.

Comparing the performance of the student cohorts in the academic year 2002-2003 and 2003-2004 was difficult because there were too many variables to consider. However, when evaluating the 2 student cohorts in the academic year 2003-2004, similar results were obtained regarding the performance on the pre-class assessment objectives and the Schools’ ABOs, the impact of this measure of success is the most critical to overall performance parity.

Significant differences were noted in student performance on the pre-class assessment quizzes (fall and spring) and on the case presentations (Table 6), indicating a lack of performance parity. A factor that may have contributed to the differences is the requirement for a solid background in organic chemistry, since a greater percentage of Web students had a longer lag time between their formal study of organic chemistry and their enrollment in the Chemical Basis courses. Based on the number of students who neglected to complete all of the required quizzes, the Web cohort appeared to not take the pre-class assessment quiz activity as seriously as the campus students, particularly in the fall semester. The opportunity for faculty-encouraged collaboration on the pre-class assessment quizzes may also be less convenient for the Web students, who do most of their communication with classmates electronically. Further, campus students had the opportunity for support and guidance on quizzes from upperclass students. This seeking out of assistance from students who have already taken the course is commonplace; however, since the Web students enrolled in the 2002-2003 Chemical Basis classes were the first students to attempt the pathway, they had no upperclass colleagues to consult.

The significant difference in the case presentation scores (Table 6) may be related to the online presentation format required of Web students. The PowerPoint case presentations made by the Web students were much longer, more detailed, more complete, and took a greater commitment of time than the 25-minute in-class presentations made by the campus groups, but it was very difficult to assess the contribution of individual Web students to the final case presentation. Each group of Web students was required to facilitate class discussion on their case through the course discussion board for 1 week after case posting, which may have contributed to the lack of participation by some.

The percentage of students earning specific letter grades was different for the campus and Web cohorts in both fall and spring semesters. The percentage of Web students who performed at an 'A' level was higher than that for campus students, particularly in the spring semester. This indicates that once the Web students understood what was required for success in the Chemical Basis courses, they were able to perform. The percentage of Web students at the C+ level in the spring term is higher than the percentage of campus students at this grade level, and reflects the significantly lower num-

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quizzes. In 2003-2004, on-campus students scored significantly better \( (p < 0.001) \) than the Web students on quizzes in both fall and spring semesters. In addition, no performance parity was observed on examinations and course scores in the fall semester, while performance parity was obtained on examination and course scores in the spring (Table 8).

The significant improvement in performance of both campus and Web students on examinations in the spring semester compared to the fall semester (Table 8) is encouraging. This is consistent with the improvement observed in student performance in the academic year 2002-2003, and supports the fact that most students adjust to, and become comfortable with, course requirements and expectations as the academic year progresses.

**Educational Mentor**

During the fall 2002 semester, there were 3 *Chemical Basis* educational mentors, but a decision to use a single mentor for the spring term was made following evaluation of students’ needs and mentor responsibilities. The instructional methods (Table 1) and the activity grid (available from the authors) helped the instructors better articulate how the mentor could assist in facilitating Web-based learning. However, the high number (50%) of Web students who were neutral about the anticipated benefits of their educational mentor in spring 2003 also indicated a lack of utilization of the mentor’s services, and failure by the faculty members to effectively communicate the mentor’s important role. In addition, all instructors were actively involved in facilitating student learning, which may have contributed to more student dependence on the instructors rather than communication with their mentor to get questions answered and concepts clarified.

In the academic year 2003-2004, Web students were informed during course orientation, via e-mail and through the course Web site about the role of the educational mentor, and how to successfully work with the mentor to facilitate their learning. The objective mentor evaluation data from spring 2004 (Table 2), as well as the highly positive narrative comments by Web students from spring 2003 and 2004, indicate clearly that the educational mentor’s proactive involvement in the course facilitated student learning and may have contributed to performance parity.

**Course Evaluation**

Objective course evaluation data and student narrative comments were consistent among both student cohorts (Tables 3, 4, and 5). The similarity in the positive response to questions addressing the relationship between course content and objectives documents the perception of high course integrity (Table 3). Agreement with the integrity issue was even higher in academic year 2003-2004. The similar level of positive response to the question about examination difficulty indicates parity in student perception of course evaluation techniques. The moderate level of positive response to this question indicates a need to help all students gain a better understanding of the level of critical thinking demanded in the *Chemical Basis* courses, as well as greater familiarity and comfort with the types of questions asked on examinations.

In 2003-2004, the question related to examination difficulty was asked differently in that students were asked to indicate how the course evaluation techniques were consistent with the course syllabus. Students provided a positive perception on this issue, with 93% of both cohorts responding, “agree-strongly agree.” This is a clear indication of improvement in student perception of parity in evaluation techniques.

The higher percentage of Web students providing a positive response to the question on content presentation rate may reflect a higher level of maturity (average age 34 years for Web students vs 26 years for campus students) and better time management skills. The higher percentage of Web students responding positively to the statement that the recommended textbook effectively aided learning (32% Web vs. 23% campus) indicates a greater willingness by the Web students to engage in independent learning. The low overall percentage of positive responses for both groups to the textbook question may be related to students’ perceived lack of need for such a learning tool and/or their need to utilize a text that emphasizes the chemical rationale behind therapeutic decision-making and better complements course content.

In 2003-2004, narrative course evaluation responses from both student cohorts on the quality of the learning environment indicate a high level of satisfaction with how the *Chemical Basis* courses are conducted. Concerns about continuity between instructors, uniform/consistent format of course notes, and topic alignment with pharmacology were expressed by fewer students than in the previous year, and other concerns identified in 2002-2003 (Table 4) were not mentioned. This is an indication that the modifications made for 2003-2004 improved students’ perception of course mechanics and course quality. The improvement in student attitudes could, in turn, have positively impacted learning, as indicated by a higher level of performance parity on examinations and final course grades.
Instructor Evaluation

Table 5 presents the representative perception of both student cohorts about one of the course instructors. The data show that the 2 student cohorts have similar perceptions about the organization and clarity of information contained in the course syllabus and handouts, teaching effectiveness, and attitude. Differences existed in student perception of the clarity of verbal presentations, the effectiveness of case-based examples in promoting learning, the appropriate incorporation of technology to aid learning, and the success with which the faculty members prepared them to think as health care professionals.

While the students responded differently to the 3 course instructors, the representative course instructor evaluation data (Table 5) clearly indicates parity related to student perception of the role and involvement of the instructors in promoting learning. The difference in responses to the clarity of verbal presentations item may be related to the fact that some Web students do not listen to the audio files of the classroom-based lectures made available on the course web page. The audio files were made available for the first time during the spring semester of the 2002-2003 academic year based on students’ summative evaluation in fall 2002. This lack of maximum utilization of resources may be related to the fact that the audio files are not specifically prepared for, or directed to, the Web students. The higher percentage of campus students indicating that the instructors encouraged discussion (81% campus vs 57% Web) emphasizes the need for faculty members to be more involved in the online Web student discussions despite that this is clearly identified as a mentor responsibility.

Course Modifications

Based on 2002-2003 and 2003-2004 student performance, and course and instructor evaluation results, a number of course modifications have been made, or are planned, to assure learning and performance parity.

Since it has been documented that the Web students collectively had a larger time gap between their organic chemistry and medicinal chemistry coursework, an organic chemistry review session was developed for, and is offered to, this group in a face-to-face format during the summer preceding the first Chemical Basis course. The session is videotaped for, or given in a recitation format to, campus students in the fall.

Several approaches are being taken to help all students master course content and understand the level of performance required to earn top marks. This is very important in the fall semester since students appear to adjust and become more comfortable with course expectations in the spring. Currently, the Chemical Basis instructors are:

- allocating 2 lectures at the beginning of the fall semester to introduce students to the discipline of medicinal chemistry, clearly articulate instructor expectations and willingness to be learning partners with students, and share student and faculty-generated tips for success;
- posting the key to the previous year’s examinations on the course Web site, along with a representative sample of previous examination questions for students to attempt on their own;
- presenting practical applications of course content (eg, case studies, SBTEs, structure challenges) in class so that students are transitioned and guided to higher levels of thinking;
- continuing to post audio files of in-class lectures and discussions on the course Web site for use by Web students. Campus students are denied access to these audio files in order to encourage their regular attendance in class;
- emphasizing the role of the mentor to Web students at the summer orientation session and throughout the year; and
- instituting sessions of the Who Wants to be Med Chem Millionaire? learning game9,10 during the class period preceding each examination as an interactive examination review.

The emphasis on active learning, critical thinking, and the practical application of course content to patient care that is integral to the Chemical Basis courses is viewed as challenging by most students and causes some to exhibit “avoidance behavior” if they are not immediately successful. During academic year 2003-2004, attending the formal in-class/online presentation was not required. However, the students were given case study and SBTE cases to work on and present informally in class. This served as a capstone exercise to show overall understanding and ability to apply course content in a practical way, similar to that expected on the examinations. Despite that the faculty members repeatedly emphasized the importance of active participation in class activities, attendance still suffered. Beginning in fall 2004, a required attendance policy was instituted for campus students. There is no plan at this time to require Web students to post on discussion boards. Since the educational mentor proactively engages that cohort in discussions on course content, and Web student participation in course activities are monitored by the faculty members and mentor throughout the semester.
In conclusion, the parity evaluation conducted by the Chemical Basis faculty member proved to be valuable in helping the instructors and mentor understand how to better ensure learning and performance parity between the 2 student groups. We found that the instructional methods employed in the Chemical Basis courses in 2002-2003 resulted in partial performance parity between campus and Web students and that the educational mentor assisted Web students in the quest for learning and performance parity with campus students. The course modifications adopted in 2003-2004 included: (1) the institution of a voluntary organic chemistry review session, (2) making audio files of in-class lectures and discussion available to Web students, (3) a more explicit promotion of the role of the educational mentor in facilitating learning for Web students, and (4) adoption of the School’s standard course Web site template. While total learning and performance parity may be an unrealistic goal due to the differences in both the methods of course content delivery and the demographic characteristics of the student cohorts, the Chemical Basis faculty members will continue to thoughtfully analyze and evaluate their courses in a formative and summative manner, and make needed modifications to maximize performance and learning parity between campus and Web students, and to optimize learning for all.

Appendix 1. Preassessment Quiz

MAO-I & SSRI Pre-Assessment Quiz
Due: Monday, Dec. 1, 8:00 AM

1. Which of the following statements about MAO-I is true? [2]
   a. MAO-I are considered first line therapy.
   b. MAO-I action results in increase in the concentrations of NE, 5-HT and DA within the neuronal synapse
   c. All marketed MAO-I act irreversible and non-selectively.
   d. All of the above
   e. b and c

2. MAO-I have a slow onset and long duration of action [ T , F ] [1]

3. Which of the following statements is true regarding the action of MAO-I? [2]
   a. Non-selective action of MAO-I is due to inhibition of all types of amine oxidases including MAO-A and MAO-B
   b. Non-selective agents could cause a hypertensive crisis if co-ingested with food containing tyramine
   c. Irreversible acting MAO-I form a covalent bond with the enzyme
   d. All of the above
   e. a and b

4. Which of the following statements is/are true regarding MAO-A and MAO-B? MULTIPLE ANSWER [3]
   a. MAO-A inhibitors are used as antidepressants
   b. MAO-B inhibits the metabolism of dopamine in the brain
   c. MAO-B inhibitors can be use in the treatment of Parkinson disease
   d. MAO-B inhibitors have the same risk for hypertensive crisis as non-selective MAO-I
   e. MAO-A has less risk for hypertensive crisis compared to non-selective inhibitors
   f. Only MAO-A can metabolize tyramine

5. MAO-I are used if other antidepressants are not effective and usually in combination with SSRI [ T , F ] [1]
Appendix 2. Mentor responsibilities

1. Initiate the first communication with the class, providing times available to students and other information deemed pertinent.
2. Establish norms for communication with and between students. Some suggestions to consider include:
   - Be respectful of the opinions of others.
   - Assist classmates who are having difficulty with course content.
   - Do not be impatient with those who learn this material at a slower pace than you.
   - Do not be shy or intimidated about asking questions.
   - Mentors, instructors and classmates are all here to optimize the learning of everyone.
   - View each Chemical Basis lesson and the graded assignments as learning experiences in which all can succeed.
   - If you must compete, compete with yourself and the body of knowledge waiting to be learned.
   - Share relevant life and work-related experiences to stimulate discussion about course topics.
   - Find and share Web sites and journal articles that have specific reference to course content.
   - Students should stay current with course content and adhere to the Planned Schedule of Learning so that course discussions are pertinent and manageable.
   - We want to hear your thoughts and opinions, but do keep contributions short, focused, and to the point.
3. Answer students e-mails within 48 hours of receipt.
4. Facilitate the on-line discussion following the pre-assessment quiz and the active learning sessions.
5. Conduct a weekly recitation via electronic on-line conferencing.
6. Monitor course discussion and keep discussions on track
7. Summarize major learning issues from student email messages and on-line discussions for instructors’ response, if needed.
8. Communicate regularly with the instructors to avoid/solve problems and share techniques that advance learning.
9. Complete the evaluation of the mentoring experience at the end of each semester.