BIO 151: Applied Biology - Developing Creative Learning Partnerships with Blackboard VISTA™

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Abstract

Teaching large, undergraduate, non-major biology courses represents an enormous hurdle for any instructor. Effectiveness in this endeavor requires innovative techniques addressing multiple activities including active student engagement, automated quiz and exam mechanisms, and accurate record keeping. In this particular case study, students were asked to "partner" with the instructor and produce multimedia presentations of important course concepts. Learning management software (Blackboard VISTA™) was utilized to automate delivery, grading, and recording of quizzes and exams. A class of 167 students majoring in business was divided into groups of 5-6 individuals per group. Over the course of the ten-week term, 34 multimedia presentations were given by these groups. Two major exams and multiple lab activities including quizzes were delivered, graded, and recorded using Blackboard VISTA™. Overall, this large course was effectively taught by encouraging student engagement through active participation in the development of multimedia presentations. Effective management of the course was realized through reliable technological support of administrative functions using Blackboard VISTA™ learning management software.

Keywords: instructional design, student engagement, multimedia, record keeping, large class, undergraduate, non-majors science

Introduction

Large classes, in general, often suffer from lack of student engagement. Large science classes are no exception. Wood states,

> We are not doing a good job at teaching undergraduates, at least in our introductory and non-majors science courses. Students are still coming away with the view that science is primarily a collection of facts, and we are generally failing to help them progress from thinking as novices to thinking as experts. In these large courses, we do not engage our students actively; rather, we lecture to them. (Wood, 2004, para 2).

Weiman indicates that there is a large and growing body of research indicating that post-secondary science education is failing to reach the educational goal of having students, even non-science students, understand science and think about science more like a scientist. He suggests that,

> Although most of the research has examined students' learning of physics, there is a significant amount of data on the learning of chemistry and some for biology as well. All of these results show a consistent pattern. Most students are learning that the subject is a set of facts that are unrelated to the workings of the world and are simply to be memorized without understanding, and they learn to "solve" science problems by memorizing recipes that are of little use other than passing classroom exams. Furthermore, they are leaving their courses seeing the science as less interesting and relevant than they did when they started. The typical student is *not* learning to see the science like an expert, as a set of interconnected experimentally determined concepts that describe the world. They are also not learning the useful concept-based problem solving methods of experts that can be applied in many different contexts." (Weiman, 2007, p.2)

The University of Delaware's Institute for Transforming Undergraduate Education (ITUE) concurs with Wood and Weiman by indicating that,

> Traditionally, many science classes have been conducted in 50-minute content-driven lectures. Abstract concepts and principles are often presented first and only later illustrated with idealized examples that may be far removed from the students' personal experiences or interests. Memorization of facts and algorithmic problem solving are often stressed, rather than conceptual understanding … In short, the structure of traditional science courses erects numerous roadblocks to students becoming actively involved in their learning." (ITUE, 1996, Statement of the Problem section, para 1).

Science courses for non-majors ("service" courses) often also suffer from poor reputations. ITUE concludes that these courses are perceived by students as irrelevant and that the material is not placed in appropriate, broad context:

Novice learners have a much more fragmented view of knowledge than do their instructors; without explicit connections between the ideas in these courses and those in the major discipline, or with the student's prior knowledge and anticipated experiences, the motivation needed to benefit fully from such courses may be seriously lacking. (ITUE, 1996, Statement of the Problem section, para 2)

Moreover, administrative tasks for large science courses, whether for majors or non-majors may be inaccurately and inconsistently performed primarily because of the large numbers of students involved. These flaws become painfully obvious if the "number crunching" for grades is done manually and/or, as is often the case, poorly supervised, over-worked teaching assistants (TAs) are carrying the major responsibility for this aspect of the course.(J. Huggins, personal observation, September - December, 2005).

This paper presents an innovative design for a general biology course (lecture and laboratory) given to non-major business students. The overall goals of this design were as follows: 1) to engage students more fully with the subject matter and 2) to make record keeping more accurate and transparent to the students during the course of the term. To achieve these aims, students and instructor "partnered" for delivery of course materials resulting in greater opportunities for students to find/develop resources germane to course content and to participate creatively in presentation of these concepts. Exams and quizzes were automatically delivered to students using Blackboard VISTA™ software. Blackboard VISTA™ was also used to grade exams/quizzes and record those scores in the class grade book where students could access their scores promptly.

Methods

BIO 151: Applied Biology, is a non-majors, "service" course taught each of four quarters by the Department of Bioscience and Biotechnology at Drexel University. The course is designed to teach undergraduate business majors general concepts in the biological sciences with an emphasis upon application of these principles to current issues in ecology, medicine, and genetics. Enrollment ranges from approximately 50 to 250 students depending upon which term of the year the course is offered. Lectures are given twice weekly; students are expected to participate in one 2-hr supervised laboratory experience per week. One instructor and two to three laboratory assistants are generally assigned to teach/administer the lectures, exams and lab exercises. The textbook used for the course was that by Belk and Borden (2007).

This course could be termed a "web-enhanced" course as it was delivered with the aid of Blackboard VISTA (version 3) software which provided e-mail, lecture materials, and exams to students (Figure 1). Grades for the course were derived from a midterm (25%) and final exam (25%), a group presentation project (25%), and a lab score (25%).

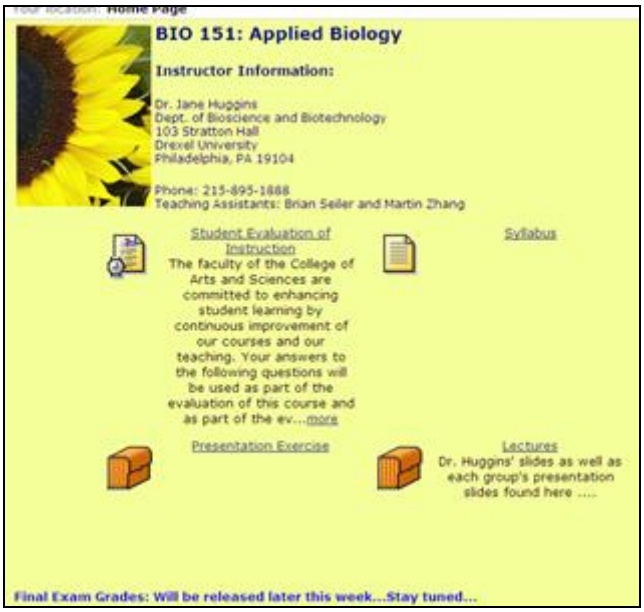

Figure 1. Homepage for BIO 151: Applied Biology

Exams

Exams contained 25 multiple-choice questions and were "open-book" format. Typically each exam was released electronically on Friday and due on Monday of the following week. The instructor contributed half the questions on each exam, the other half were contributed by the presentation groups based on the concepts in their presentation.

Presentation Project

Presentation groups for each week of the term were developed using the "Group Manager" feature of Blackboard VISTA™. Five to six students were encouraged to voluntarily sign-up for each group (Figure 2).

BIO 151 Presentation Groups

Group Name	Maximum Members	Members
BIO151 01	5	(4) Ms Erica Alman , Mr Hasnain Chinwalla , Ms Tracey Fruh , Ms Aesha Mehta
BIO151 02	5	(6) Mr Paul Kumor , Mr Manuel Pesantes , Ms Maham Siddique , Ms Yu Sun , Ms Lauren Wetzel , Mr Christopher Young
BIO151 03	5	(5) Mr Mervin Choun , Mr Lucian Herciu , Miss Brenna Margol , Ms Anne Nguyen , Ms Kathleen Whyte
BIO151 04	5	(5) Mr Benjamin Campbell , Ms Bridget Kleinberg , Ms Alicia Luchetti , Ms Kelly Sawka , Mr Kurt Stine
BIO151 05	5	(4) Mr Paul Dorio , Miss Callan Fitz Patrick , Ms Stephanie Roche , Mr Tony Santos
BIO151 06	5	(5) Ms Elaine Chan , Mr Andrew Hallett , Ms Haejin Kwon , Mr Chris Mctyre , Ms Tea Nikic
BIO151 07	5	(5) Mr Christopher Alfano , Ms Lisa Ciechanowski , Ms Barbara Menico , Mr Stephen Nicolo , Ms Melanie Skloff
BIO151 08	5	(5) Mr Matthew Blakeslee , Mr Amar Brahmbhatt , Ms Mary Cate Cassidy , Ms Violetta Shubayeva , Ms Samantha Tom
BIO151 09	5	(5) Mr Raul Dazon , Ms Lisa Mehta , Mr Jed Singer , Mr Joby Varughese , Mr Manu Varughese
BIO151 10	5	(5) Mr Christopher Adams , Mr Michael Donaghy , Mr James Englehart , Mr Nicholas Illuminati , Mr Evan Wang
BIO151 11	5	(5) Ms Nina Buratti , Miss Jennifer Chruszcz , Ms Amanda Cunningham , Mr Christopher Paquette , Mr Jason Sweedler

Figure 2. Signup Sheet

Discussion groups were also set up in Blackboard VISTA™ and linked to each presentation group. This linkage provided an electronic "meeting place" for each group to plan their presentation if needed (Figure 3).

Each presentation group was assigned the task of developing 10-15 PowerPoint slides about a concept germane to the lecture material for the week chosen for their presentation. Four groups presented per week in the ten week term. The instructor delivered a lecture during the first lecture period each week (Tues.) on the basic concepts presented in the assigned textbook chapter for that week. Student groups gave their presentations during the second lecture period each week (Thurs.) Group presentations were recorded using a video camera. PowerPoint™ slides from each presentation as well as the video clip were posted to the course website each week and were available to students during their exam periods (Figure 4).

Twenty-five points were awarded for each presentation according to the following rubric: 1) 5 points for making the presentation; 2) 5 points for good organization of concepts (e.g. introduction to the issue, development of information, emphasis provided by multimedia, basic conclusions); 3) 5 points for incorporation of a germane multimedia feature; 4) 5 points for providing the instructor with an electronic copy of the presentation; and 5) 5 points for developing an exam question from the presentation. An extra five (5) points were added to scores for individuals in the first eight (8) groups giving a presentation. The extra points served as an incentive for student participation during the early weeks of the term.

Laboratory

Typically, students were enrolled in 1 of 10 to12 individual lab sections of approximately 20 students each. The lab sections were "cross-listed" in the Blackboard VISTA™ course module to enhance efficiency with regard to uploading of laboratory instruction materials as well as administration/grading of weekly quizzes. "Cross-listing" is a term which is synonymous with compiling all the lab sections together on one site so that lab instructions and other materials only have to be uploaded to the site once. Each lab section was given a unique identifier so that the entire "cross-list" could be searched and sorted for results by lab section if needed (Figure 5).

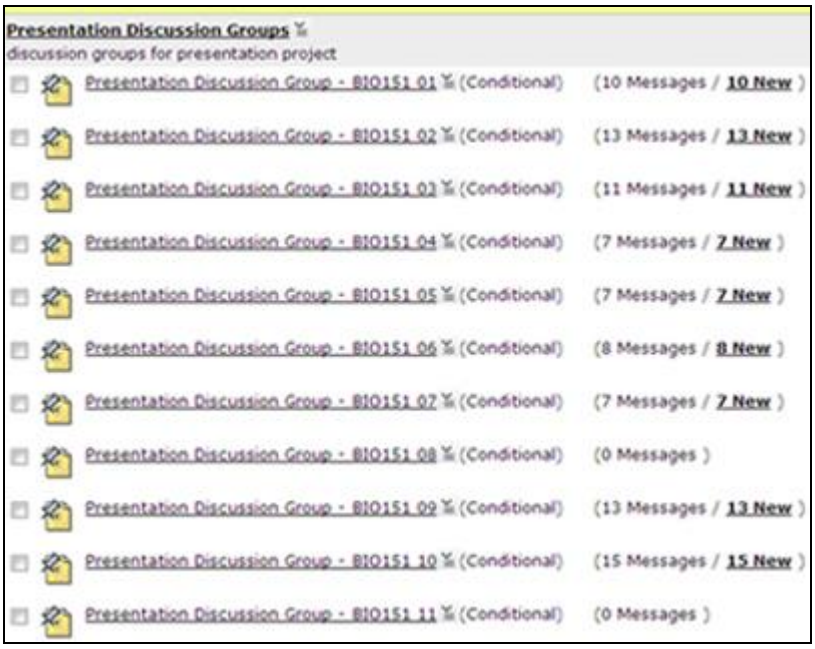

Figure 3. Discussion Groups

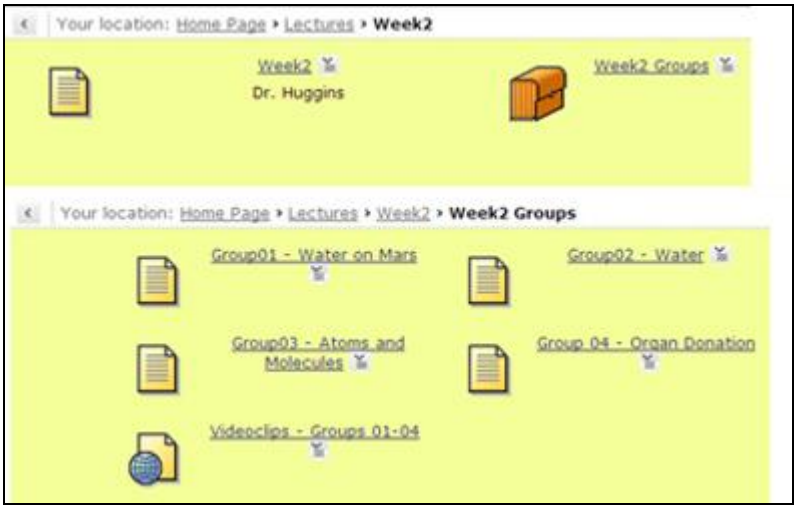

Figure 4. Instructor/Student Weekly Lecture Slides and Videoclips

Cross-Listing Information Alphanumeric	Wk3: Att Numeric (out of 1)	Macromolecules Quiz (out of 5)
BIO-151-074 - SU05	1.00	5.00
BIO-151-074 - SU05	1.00	5.00
BIO-151-074 - SU05	1.00	5.00
BIO-151-074 - SU05	1.00	2.00
BIO-151-074 - SU05	1.00	4.00
BIO-151-073 - SU05	1.00	4.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	4.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	3.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-073 - SU05	1.00	5.00
BIO-151-070 - SU05	1.00	3.00
BIO-151-070 - SU05	0.00	--

Figure 5. Cross-Listing of Lab Sections

Laboratory scores were based on weekly quizzes emphasizing the basic principles behind the laboratory exercise(s) and student attendance. Weekly quizzes were automatically and selectively released to each individual lab section of students with deadlines for completion specific to each section (Figure 6).

Figure 6. Selective Release of Lab Quizzes to Multiple Sections

Scores for weekly quizzes were made immediately available to students upon completion of the quizzes. Correct answers for the quizzes were usually available one week following the quiz due date. Student lab attendance was manually entered (by TAs) into the grade book as a "1" for attendance or "0" for non-attendance. At the end of the term, this attendance column was multiplied by the weekly quiz score. Hence, students who may have taken the automated quiz, but did not actually attend the weekly lab, scored no points for the quiz (i.e. 0 (attendance) x 5 (quiz score) = 0). In this manner, attendance was linked to quiz score (Figure 7).

Total Lab Points Calculated (out of 40)	Wk3: Att Numeric (out of 1)	Macromolecules Quiz (out of 5)	Wk5: Att Numeric (out of 1)	Wk5: Cellular Drawings Numeric (out of 5)
40.00	1.00	5.00	1.00	5.00
39.50	1.00	5.00	1.00	5.00
(25.00)	0.00	--	1.00	5.00
40.00	1.00	5.00	1.00	5.00
N/A	--	--	--	--
39.50	1.00	5.00	1.00	5.00
39.00	1.00	5.00	1.00	5.00
N/A	--	--	--	--
40.00	1.00	5.00	1.00	5.00
(34.50)	1.00	5.00	1.00	5.00
35.00	1.00	5.00	1.00	5.00
39.00	1.00	4.00	1.00	5.00
35.00	1.00	5.00	1.00	5.00
38.00	1.00	5.00	1.00	5.00
38.00	1.00	4.00	1.00	5.00
38.50	1.00	5.00	1.00	5.00
38.00	1.00	3.00	1.00	5.00

Figure 7. GradeBook, Laboratory Quiz Columns

The final score for the lab was tabulated by adding the number of points achieved on each lab quiz (multiplied by attendance). The tabulation was automatically calculated by Blackboard VISTA™ (Figure 8).

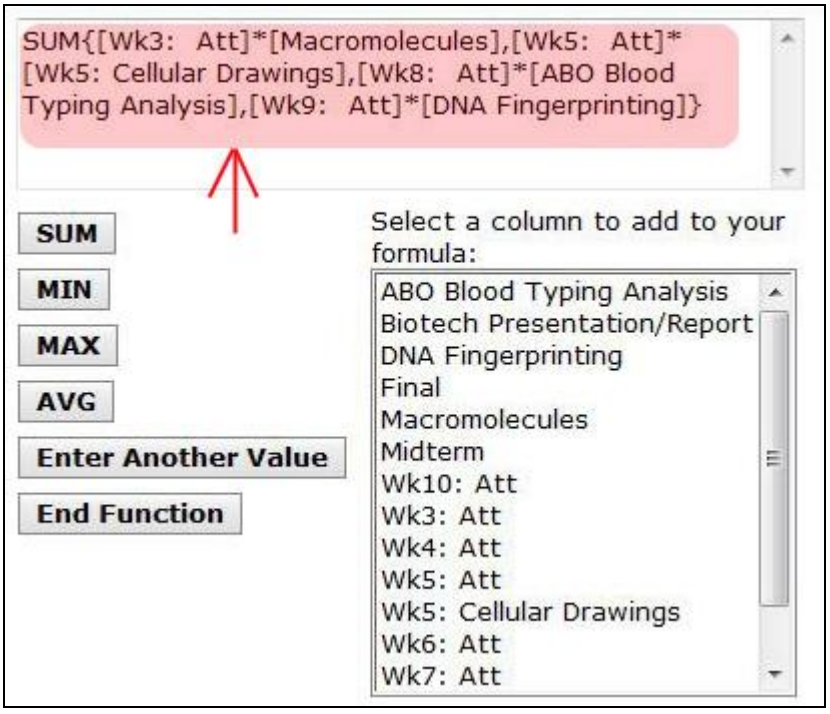

Figure 8. Laboratory Total Score Calculation

The calculated total lab score was subsequently integrated into the calculations determining the final grade for the course (midterm + final + presentation + lab total score) which was also automatically calculated by Blackboard VISTA™.

Results

Exams
The percentage of students in BIO 151 completing their exams by the due date was 93% and 92% for midterm and final exams, respectively. Very few, if any, technical problems were reported, due in part, perhaps, to an exam tutorial placed on the homepage. The tutorial included a short video clip explaining the exam procedure and a small, demonstration exam in Blackboard VISTA™. The average score on the midterm exam was 23.5/25 points (max: 25; min: 19). The average score on the final exam was 22.4/25 points (max: 25; min: 17).

Presentation Project
Thirty-four (34) groups of 5-6 students gave presentations during the term on topics found in textbook chapters, two through ten (2-10). Title slides from 19 of these presentations can be viewed by following this link: BIO 151 Presentations

Laboratory
The percentage of students in BIO 151 completing their laboratory activities was 93%. The average total score for laboratory activities was 21.1/25 (max: 25; min: 3).

Final Grades
Approximately 25% of the students in this course made an A+; 50%, an A. Grades of B or lower were distributed as indicated below:

- A+ (97% and above) -- 27.8%
- A (90-96%) -- 52.7%
- B (80-89%) --13.3%
- C (70-79%) -- 2.4%
- D (60-69%) -- 0.6%
- F (less than 60%) -- 2.4%

Discussion

Historically, BIO 151: Applied Biology has been considered a difficult course to teach. For students, it has been an unwanted, but necessary course for which to register in order to graduate. Classes (and laboratories) have often been plagued by low attendance. Poor performance and steadfast lack of interest on the part of student and instructor were characteristic of this course. Unfortunately, a large communication gap was also in evidence primarily because neither party cared a great deal about what the other party had to say.

This case study attempted to remedy at least some of these ills by offering students a chance to engage more personally (fully) with the concepts being taught; to assume, as it were, the role of “lecturer for a day”. Moreover, accurate, efficient record keeping of scores was provided which enhanced the integrity of the course and elevated the level of student trust in the course, the instructors, and the teaching assistants.

Exams
The goal of the exams given in BIO 151 was to provide an opportunity for students to review the material presented (both by them and by the instructor) and to touch base, once again, with the basic concepts and issues addressed during the term. Needless to say, rote memorization of fact was not needed (or expected) in order to pass these exams. Rather, students could access exam materials easily through Blackboard VISTA™, review them, and select (hopefully) the best answer(s) for the questions posed. Moreover, Incorporation of questions from student presentation materials on exams broadened the exam experience for many in that not all the correct answers could be found in the textbook, but rather in the

slides, video clips, and URLs of student presentations. The high incidence of good scores on these exams indicates that students were successful in reviewing and understanding the basic concepts presented. Due to the fact that exams were in open-book format and available to students for a period of about 3 days over the exam weekend, there really was no method by which to monitor students during exam-taking. Hence, student collusion on the exams could have occurred. However, student collaboration was encouraged for exam-taking as a part of the emphasis on group interaction in this class. Moreover, it was felt that this type of encouragement tends to mitigate, to a certain extent, dishonest intention with regard to taking exams. The need to "cheat" is removed, essentially; collaborative interaction is supported, and many students benefit from a group experience in which potential answers to the exams are researched. So, while some collusion may have occurred; true collaboration did as well.

Presentation Project

The presentation project allowed space for student creativity, not only with regard to selection of topic, but also in reference to graphic design and incorporation of multimedia resources. For example, although "You-Tube" video clips are not always considered of highest quality in terms of production conditions, their incorporation into some of these presentations required review and analysis of the clip by students and considerations with regard to appropriateness. Many of the clips presented (whether from You-Tube or other sources) reflected careful consideration by students as to how the clip could enhance the presentation. For example, the presentation about "Water on Mars" incorporated a video clip of NASA's Mars Rover and its search for water on Mars. The presentation about "Organ Donation" included a video clip from the movie, "John Q" which depicts a father's frantic search for an organ for his dying son. An excellent video clip about anorexia was included as part of the presentation about "Eating Disorders". Overall, this particular aspect of the course provided a good outlet for student creativity and engaged them very effectively with the subject matter.

Laboratory

Many students from non-science backgrounds are daunted by a "hands-on" laboratory experience. In view of this reticence to embrace laboratory experiments wholeheartedly, the laboratory activities for these students included well-planned (and explained) experiments with historically, a very small chance of failure. An attempt was also made to balance their exposure to activities in which a reasonable level of technical expertise was required with activities which relied more fully on audio-visual materials. Moreover, incorporation of simple quizzes on the basic principles behind each laboratory activity served to reinforce those principles. In short, laboratory activities for non-major students do not have to be difficult to engage them. Rather, simple, straightforward expressions of basic concepts are probably more effective. As with the major exams given in this course, the percentage of high scores on lab quizzes/exercises indicates a good grasp by students of the principles presented in laboratory activities.

The decision to give lab quizzes on basic concepts versus requiring a formal laboratory report on each exercise was based on several factors. The first factor was the large enrollment for this course making individual grading of lab reports an arduous, time-consuming weekly process. Secondly, the subjectivity and lack of consistency exhibited by TAs (and instructors) with regard to manually grading lab reports is well-known and would be possibly compounded by the large numbers of reports in this instance. Finally, the instructor felt that very few if any non-major students would be required to write formal lab reports in their chosen jobs/careers upon graduation

Conclusions

One of the major conclusions from this case study is that student creativity should not be underestimated simply because the course is a non-majors course. Creativity may lie dormant in many non-major courses because it isn't tapped by the traditional teaching formats often used in these courses. (This could also be said of traditional teaching formats in major courses!). Giving creative voice to students, even in courses which are not in their major area, provides both students and instructor ample "play" space in which to explore any/all concepts under study. Incorporating multimedia elements into this "play" space also serves to enrich the learning/teaching experience.

While it is true that not all students (or instructors) will take advantage of this type of opportunity, encouraging student participation in the development of lectures/materials for the course establishes a

direct conduit to the concepts being taught. The student views presented are often refreshing and reflect their unique perspectives on the issues underlying the material. The particular requirement that students work in groups stimulates interaction between students which also enhances their appreciation of alternative viewpoints.

This case study also underscores the fact that effective, automated record keeping is its own reward in large courses in which student performance on a large number of different activities has to be recorded accurately. In this particular course, 167 students completed 2 major exams, a presentation project, and at least 5-8 laboratory activities. Each individual's laboratory attendance was also monitored for 10 weeks. Hence, a total of approximately 3000 data points were used to obtain final grades. Utilization of Blackboard VISTA™ to automate quiz/exam delivery/grading, and compile attendance as well as presentation project scores was extremely helpful and emphasizes the fact that large numbers of students are "doable" in terms of record keeping if you automate it. Moreover, the course motto of "everything in the grade book" encouraged students to check the grade book for their scores on all activities and to contact either instructor or TA if they felt something was amiss. This "transparency" gave them a sense of ownership and prompted stewardship with regard to their scores and, eventually, their final grade.

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