

**BROWARD COMMUNITY COLLEGE
TEACHING/LEARNING COMMUNITY
CLASSROOM RESEARCH AWARD**

EVALUATION FORM

Please complete this form for the research project that you conducted for the T/LC award. This information will be reviewed in order to evaluate the effectiveness of your research. Your evaluation and supporting documentation will be posted on the T/LC Website. Use additional paper where necessary.

Note: Please submit this form and your supporting documentation within 30 days of the completion of your project to Staff Development via email or on a disk (in Word format). Send a hardcopy (and disk) of your project to the Staff Development Office, Downtown Center - Room 605.

Name: Susan F. Finazzo, Ph.D. **Date:** May 26, 2003

Signature: _____

Research Title: Will the Use of Online Pre-Laboratory Discussions and Quizzes Improve Student Performance in the General Biology Laboratory?

Project Completion Date: May 2003

1. State the problem/idea you researched/examined.

Students enrolled in general biology laboratory are often unprepared for the depth and scope of the laboratory activities. As a result they may become frustrated or overwhelmed during their time in lab. Simple preparation, such reading the laboratory beforehand would reduce the student's confusion in lab. However in today's busy society students are unlikely to perform proactive studying unless there is a demonstrated and tangible (grade) benefit. Many of the laboratory activities are more than 10 pages long and the novice scientist would be unable to understand and prioritize objectives. I would like to examine if student laboratory performance and understanding would improve, if students were required to read a brief online pre-laboratory summary and to take a pre-laboratory quiz prior to coming to laboratory.

2. Provide a summary of the results of your research.

Qualitative Assessment:

Students appeared better prepared for lab. Many students actually printed the pre-laboratory materials and brought them to lab with them. I often observed students

referencing their highlighted pre-lab discussions. Students managed to more efficiently schedule their activities and complete their lab work. During the two semesters (~9 sections) that I followed student performance on only 3 occasions did the lab run over the 110 minutes scheduled. Normally during a regular semester students have difficulty completing about 6 of these labs during the scheduled lab time, not because the labs can't be done in that timeframe but because students don't delegate work to each other and manage their time poorly. Prior preparation, completing the pre-laboratory activities seems to orient the student to the day's lab activities and improve their organization.

Quantitative Assessment:

The control group was composed of students enrolled in 4 sections of general biology laboratory during the 1997/1998 school year. If students did not take the quiz for a lab (grade recorded as a zero) the grade was discounted. The maximum number of data points for the control group was 96 grades. The sample size was lower for some labs in some instances because of student absences and missed labs (college schedule of holidays made it impossible to schedule some labs).

The experimental group was made up of sections of general biology laboratory from this semester and last (20031,20032). If students did not take the quiz for a lab (grade recorded as a zero) the grade was discounted. The maximum number of data points for the control group was 145 grades.

Student T-test:

The student t-test is a statistical test that gives the probability that two sets of data are statistically the same. The t-test does not require an equal number of sample points. It does require a normal distribution and similar standard deviations for the two populations. If the probability is greater than 0.05 then the populations are the same and any differences between the two simply reflect sampling error. In this case a probability greater than 0.05 would signify that students in both the experimental and control groups performed equally well. If the probability is less than 0.05, then there is a significant difference in the means of the students' grades.

Students do not have access to a pre-laboratory for the animal aggression lab and some students did not access the microscope pre-laboratory. All things being equal the test scores for the control group and the experimental group should be similar. However, the t-test probability indicates that there was a significant difference in the mean test scores of the two groups. The control group scored significantly higher than the experimental group. (Red type in the table below indicates significantly higher mean for the control group). This could simply be a fluke or it could indicate that the control group simply tested better. Whatever deficiencies that were evident in the scores of the first two quizzes were minimized as the semester continued and students accessed the pre-laboratory materials.

The t-test indicated there was no difference in test mean scores between the control and experimental group for 4 of the laboratory quizzes (cell chemistry, enzymes, paramecium, and animal form) as indicated in black print in the table below. That suggests that the pre-laboratory activities may help equalize the disparity evident in the quiz scores for the first two laboratories.

The t-test probability indicated that there was a significant difference in the mean quiz scores for the remaining 7 quizzes (shown in blue in the table). In each case the experimental group scored significantly better than the control group. The online pre-laboratory quizzes and discussion was the only known variable between the control and experimental groups that could account for this improvement from scoring significantly worse to scoring consistently better than the control group.

Lab Activity	T value	Stan. Dev.	Degrees of Freedom	Probability
Animal Aggression	7.78	1.78	225	<.0001
Microscope	4.00	2.16	224	<.0001
Cell Chemistry	1.19	1.90	238	0.23
Enzymes	0.289	2.03	236	0.77
Membranes	-3.57	2.31	180	0.0005
Bacteria	-2.02	1.83	203	0.045
Paramecium	-0.646	2.15	238	0.52
Cell Ultrastructure	2.77	2.00	231	0.0061
Mitosis	-2.79	2.32	176	0.0058
Heredity	-7.05	2.03	227	<.0001
Development	-2.57	2.27	225	0.011
Plants	2.78	2.02	229	0.0060
Animal Form	0.683	1.94	225	0.50

3. Please describe the methods you used to evaluate the effectiveness of your project. Include any quantitative and/or qualitative supporting data.

Students will be required to read an online (WebCt) pre-laboratory discussion in which pertinent theory, practice and safety for each activity will be reviewed. The instructor will write the pre-laboratory discussion and online quizzes. The online discussion will be brief, but will provide an adequate orientation to the laboratory topic. Students are not meant to spend extensive periods of time reviewing the discussion.

After review of the discussion students will be required to take a short randomly generated, 5-question, graded, timed quiz covering the information in the pre-lab discussion. The question database will contain at least 20 questions. Students will be allowed to take the quiz three times. Each time the student takes the quiz a new set of questions should appear. Students must take the quiz during the week prior to the laboratory meeting. Online quizzes will be a part of the student's grade.

The effectiveness of this strategy will be determined by examining class quiz scores. The quiz scores of students in the experimental group (using WebCt pre-lab discussions) will be compared to the scores of students from previous years with the same instructor and the same quizzes. The instructor will make qualitative assessments of student ease in completing laboratory activities and quantitative measurement of time spent in lab.

Standard statistical methods will be used to analyze the student's quiz scores. Experimental and control test populations will be compared using the student T-test.

4. If applicable, identify what prevented you from achieving maximum results.

Student scores on the first two laboratory quizzes (no or little WebCt access) were very low this year when compared to scores of students just 4 years ago. I am curious to know if that is a statistical fluke or if there was a difference in academic preparedness of this year's students. A more thorough examination of student records would be needed to sort out that inconsistency. I find it significant that students with an apparent deficit in initial preparedness improved and surpassed the performance of students from previous years that scored initially higher on the first two quizzes.

Most students in this study had a home computer. Only one student lacked a computer and internet access at home. Yet technology initially still presented a barrier to some students. During the first lab all pre-registered students were given time and assistance to access the course. Some students still had difficulty accessing the course without assistance. A very few students never accessed the online materials even though they were repeatedly warned that the online quizzes were a part of their grade.

5. Please attach copies of any evaluation forms (or a summary of those forms) that you used.

Not applicable.

6. Specifically, how do you intend to share the results of your classroom research with the BCC community?

I will share these results with the BCC community via this evaluation form or in any other venue suggested by or requested by the TLC committee or other college colleagues. I plan on submitting this research for presentation to the National Association of Biology Teachers at their annual meeting in October.

7. In what ways might faculty from other disciplines apply your research?

The results of this project clearly indicate that in activity based classes prior preparation for class improves student performance in class. Even though quantitative evaluation tools like quizzes only indicated a modest improvement, qualitative assessment of student confidence and time management in classes using pre-laboratory activities showed definite improvement over previous classes which did not use pre-laboratory activities. Faculty in other disciplines may want to create materials which engage the student in some way before the assigned material is covered in class. This activity would need to be brief, focused and carry a course grade point value.

8. Other comments about your research that you wish to discuss with the T/LC or ideas for future follow-up studies in your discipline or other disciplines.

I believe the pre-laboratory activities are a good first step to improving student learning and performance in the General Biology Laboratory. Unfortunately, students are still leaving the lab without the "big picture". They need time to assimilate experimental results and to map out an understanding of the concepts demonstrated in the lab. Students rarely take notes or make adequate observations of experimental results. When they finally do try to study for the lab they remember seeing the colors and measuring the results but they have a difficult time matching the results to the activity. I would like to create follow up activities to the laboratory that students could access after completing the lab. These activities would include post-lab quizzes, video or still images of lab activities and an online discussion of the results.

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