

BIOLOGY: Assessment Report Format (Academic Programs)

Academic Year 2005-2006

I. Brief Summary of Assessment Plan

The goal(s), student learning outcome(s), associated components of the outcome(s) (if applicable), and the performance characteristics or criteria. For 2005 – 2006 the faculty agreed to assess goal #2 Methodology.

Goal #2: Methodology:

1. apply the methods biologists use to explore living organisms;
Observation
Hypothesis development
Measurement
Data collection
Experimentation
Evaluation of evidence
Mathematical analysis
2. evaluate the outcomes of scientific experiments.
Summary
Conclusions

The benchmark was 70% of the students demonstrating achievement of the outcomes.

II. Assessment Methods

See Appendices for each individual course. In addition, a pre/post test was administered in this course.

III. Description of Assessment Results

See Appendices for each individual course. The pre/post test results indicated: Exam Scores (based on 100%) Pretest: 48% Posttest: 75% Gain: 0.5096 which indicates a middle level of improvement (Scale is High, middle, low) on the Normalized Gain Scores.

IV. Use of assessment for program improvement.

BIOL-L 105 – Weaknesses were seen in the ability of students to develop hypotheses and in the evaluation of evidence. Additional work on the part of instructors will be needed here to improve this area. Assessor: C. Kinsey

MICR-M315 – Student weaknesses were reported in experimentation and evaluation of data. More time and emphasis on certain aspects of the weakness will be done to improve student benchmarks in the future. Assessor: C. Chauret

V. Dissemination of results.

A web page is under development (not yet published) to post the various assessment reports online.

GOAL # 2 METHODOLOGY

OUTCOMES

COURSES

L105 L321 L367 L364 L403 L473 L477 P416 B203 B364 M310 M315 Z315

Apply methods
biologists use to
explore living
organisms

X

X X

Evaluate outcomes of
scientific experiments

X

X X

Appendix 1

Assessment Report L 105 Introduction to Biology (Majors Biology) Academic Year 2005-2006

This report concerns assessment of Goal #2 (Methodology), and its components: 1 (apply the methods biologists use to explore living organisms), and 2 (evaluate the outcomes of scientific experiments).

The performance characteristics that were assessed are as follows:

Component 1 (Apply the methods biologists use to explore living organisms)

- Observation
- Hypothesis Development
- Measurement
- Data Collection
- Experimentation
- Evaluation of Evidence
- Mathematical Analysis

Component 2 (Evaluate the outcomes of scientific experiments)

- Summary
- Conclusions

The classroom activity being assessed was the laboratory report for the “Transformation by Plasmid” exercise. This exercise is performed in week 9 of the semester. The “Transformation by Plasmid” exercise is the first in a series of five exercises for the “Experimental DNA Module” portion which occurs during the final third of the semester.

The lab report format as assigned to the student is as follows:

L 105 Lab Report Format

Sections of your lab report should include:

- **Discussion of Key Principles**
- **Description of Materials used**
- **Description of the Procedure**
- **Description of YOUR Observations**
- **Discussion of Findings—in relation to key principles**

Key Principles

Use the background material, or introduction, to the exercise. Use your own words!

Materials

Explain what solutions, etc, were used as well as what equipment was used.

Procedure

Explain the procedure in your own words.

Observations

Tell what you saw. There is no right or wrong answer. Give an accurate description of your findings.

Discussion of findings

Explain your findings in relation to the key principles. Was it what you expected to happen? What variables might have been involved in making it turn out differently?

The performance assessment criteria are applied to the various portions of the lab report according to the following chart:

Component	Performance Criteria	Report Sections
Observation	Clear <i>or</i> Unclear	Observations
Hypothesis Development	Relevant <i>or</i> irrelevant	Key principles
Measurement	Correct <i>or</i> incorrect	Observations
Data Collection	Complete <i>or</i> incomplete	Discussion of Findings
Experimentation	Concise <i>or</i> verbose (<i>muddled</i>)	Materials and Procedure
Evaluation of Evidence	Simple <i>or</i> more fully developed	Discussion of Findings
Employment of Mathematical Analysis	Correct <i>or</i> incorrect	Discussion of Findings

The benchmark for this assessment is that 70% of the students should have demonstrated achievement of the outcomes.

The assessment was performed by Carrie Kinsey, Biology Lab Supervisor and instructor for the L 105 Biology lab. Procedure for assessment was comparison of student lab reports to the above chart with the first option in each case indicating successful achievement.

Results

Assessment was performed in both the fall and spring semesters. There are two sections of 24 students during the fall semester and one lab section of 24 students in the spring semester. By the time this exercise was performed in the fall class sizes had dropped to 11 and 12 students in the two sections. In the spring there were 16 students remaining by the time this exercise was performed.

In the fall semester results were as follows:

Observation

- Monday class 64%
- Wednesday class 75%
- Overall 69%

Hypothesis Development

- Monday class 27%
- Wednesday class 50%
- Overall 39%

Measurement

- Monday class 73%
- Wednesday class 83%
- Overall 78%

Data Collection

- Monday class 81%
- Wednesday class 75%
- Overall 78%

Experimentation

- Monday class 55%
- Wednesday class 83%
- Overall 70%

Evaluation of Evidence

- Monday class 36%
- Wednesday class 83%
- Overall 61%

Employment of Mathematical Analysis

- Monday class 73%
- Wednesday class 83%
- Overall 78%

In the spring semester the results were as follows:

Observation 100%
Hypothesis Development 19%
Measurement 100%
Data Collection 100%
Experimentation 75%
Evaluation of Evidence 63%
Employment of Mathematical Analysis 100%

For the academic year, all class sections combined results are as follows:

Observation 82%
Hypothesis Development 31%
Measurement 87%
Data Collection 87%
Experimentation 72%
Evaluation of Evidence 62%
Employment of Mathematical Analysis 87%

Data sheets are attached. Student names have been replaced with letter designations.

Indications

While students in all sections were able to collect and observe data, all sections had problems stating key principles of the experiment and relating those principles to their results. More teaching emphasis is indicated in this area.

Other issues that came up in assessment were based on the original assessment criteria. I found that while students could state relevant principles in the “Key Principles” section, they often did not state *all* the principles or aspects of the exercise. A further criterion of “complete/incomplete” could be added here. Also students had trouble explaining the procedure without just copying a list of instructions. At times they did not seem to understand what they were doing in a particular step and why that step was necessary. A further criterion of “clear/muddled” could be added here.

This lab report is the first in a series of five lab reports students must complete for this portion of the course. Often this is the first experience they have had with writing a lab report. They are allowed to write a second draft of the first 3 reports, and with some input they are able to write markedly better reports by the end of the term. An additional assessment of the last lab report "Mitochondrial DNA Analysis using PCR" may provide a good comparison and a more useful teaching tool than simply an assessment of their first attempt.

Data

Plasmid Lab Report	Monday class	Fall 05					
Name	Observation	Hyp. Dev	Measurement	Data Collection	Experimentation	Eval of Evidence	Emp of Math Analy
a	clear	relevant	correct	complete	concise	developed	correct
b	unclear	irrelevant	incorrect	incomplete	muddled	simple	incorrect
c	unclear	irrelevant	incorrect	complete	concise	simple	incorrect
d	clear	relevant	correct	complete	concise	developed	correct
e	clear	irrelevant	correct	complete	muddled	simple	correct
f	clear	irrelevant	correct	complete	concise	developed	correct
g	clear	relevant	correct	complete	concise	developed	correct
h	unclear	irrelevant	incorrect	incomplete	muddled	simple	incorrect
i	unclear	irrelevant	correct	complete	muddled	simple	correct
j	clear	irrelevant	correct	complete	concise	simple	correct
k	clear	irrelevant	correct	complete	muddled	simple	correct

Assessment--Plasmid Lab Report Wednesday Round 1 Fall 05

Name	Observation	Hyp. Dev	Measurement	Data Collection	Experimentation	Eval of Evidence	Emp of Math Analy
a	unclear	irrelevant	incorrect	incomplete	muddled	simple	incorrect
b	clear	relevant	correct	complete	concise	developed	correct
c	clear	relevant	correct	complete	concise	developed	correct
d	clear	irrelevant	correct	complete	concise	developed	correct
e	clear	irrelevant	correct	complete	concise	developed	correct
f	unclear	relevant	correct	incomplete	muddled	developed	correct
g	clear	irrelevant	correct	complete	concise	developed	correct
h	clear	relevant	correct	complete	concise	developed	correct
i	clear	relevant	correct	complete	concise	developed	correct
j	clear	relevant	correct	complete	concise	developed	correct
k	unclear	irrelevant	incorrect	incomplete	concise	simple	incorrect
l	clear	relevant	correct	complete	concise	developed	correct

Assessment--Plasmid Lab Report Spring 06

Name	Observation	Hyp. Dev	Measurement	Data Collection	Experimentation	Eval. Of Evidence	Emp. Of Math Analy
a	clear	rel/inc.	correct	complete	concise	developed	correct
b	clear	rel/inc.	correct	complete	muddled	simple	correct
c	clear	rel/inc.	correct	complete	concise	simple	correct
d	clear	rel/inc.	correct	complete	concise	simple	correct
e	clear	rel/inc.	correct	complete	muddled	simple	correct
f	clear	irel/inc	correct	complete	muddled	simple	correct
g	clear	rel/inc.	correct	complete	concise	developed	correct
h	clear	rel/inc.	correct	complete	concise	developed	correct
i	clear	rel/com	correct	complete	concise	developed	correct
j	clear	rel/com	correct	complete	concise	developed	correct
k	clear	rel/inc.	correct	complete	concise	developed	correct
l	clear	rel/inc.	correct	complete	concise	developed	correct
m	clear	rel/inc.	correct	complete	concise	developed	correct
n	clear	rel/com	correct	complete	concise	developed	correct
o	clear	rel/inc.	correct	complete	concise	developed	correct
p	clear	incomp	correct	complete	muddled	simple	correct

Appendix 2

Microbiology Laboratory M 315 – Assessment

Instructor: Christian Chauret

Semester: Fall 2005

Goal: Methodology:

Outcome: 1. apply the methods biologists use to explore living organisms;

- Observation
- Hypothesis development
- Measurement
- Data collection
- Experimentation
- Evaluation of evidence
- Mathematical analysis

Activity: Team project on microbial diversity of “simulated pond water”.

Description of the activity:

Each group of two or three students had to perform a microbial diversity project over the course of the semester. The purpose of the project was to become aware of microbial diversity and population transition in the environment. The project consisted of preparing a simulated pond ecosystem (using water supplemented with hay, grass clippings, or aquatic plants). This ecosystem was incubated at room temperature with sunlight for 6-8 weeks. The students had to make weekly observations and evaluate the microbial populations using various microbiological techniques that they had learned during the semester. At the end of the semester, each group presented their project both as a written report (introduction, materials and methods, results, discussion) and as a powerpoint oral presentation. The assessment was performed using the components and criteria listed in Table 1. A summary of the results is shown in Table 2.

Table 1. List of components, performance criteria, and sections for the report and/or oral presentation.

Component	Performance criteria	Report section and/or oral presentation section
Observation	Clear/unclear	Results
Hypothesis development	Relevant/irrelevant	Introduction
Measurement	Correct/incorrect	Results
Data collection	Complete/incomplete	Results
Experimentation	Superficial/detailed	Materials and methods
Evaluation of evidence	Superficial/detailed	Discussion
Mathematical analysis	Correct/incorrect	Results, Discussion

Table 2. Summary of the assessment exercise.

Student (1st initial)	Observation	Hypothesis	Measurement	Data collection	Experimentation	Evaluation of Evidence	Math analysis
T	Clear	Relevant	Correct	Complete	Superficial	Superficial	Correct
C	Clear	Relevant	Correct	Complete	Superficial	Superficial	Correct
S	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
M	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
D	Clear	Relevant	Correct	Incomplete	Superficial	Superficial	Correct
R	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
C	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
E	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
C	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
M	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
L	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
L	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
P	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
M	Clear	Relevant	Correct	Complete	Superficial	Superficial	Correct
M	Clear	Relevant	Correct	Complete	Superficial	Superficial	Correct
E	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
T	Clear	Relevant	Correct	Complete	Detailed	Detailed	Correct
V	Clear	Relevant	Correct	Complete	Detailed	Superficial	Correct
I	Clear	Relevant	Correct	Complete	Detailed	Superficial	Correct

Analysis:

Overall, the students were extremely enthusiastic about this experiment and most of the groups were very thorough in all aspects of their work. Twelve out of 19 students (63%) have performed adequately for all seven components. When problems were encountered, it was mostly with “experimentation” and “evaluation of evidence”. I noted that while students generally could collect data very efficiently, several of them had difficulty providing an appropriate interpretation of the data. Often, their interpretation was either superficial or lacking some important elements. Another area of difficulty that I noted was the “experimentation” part. Several students have difficulty adequately (completely and succinctly) describing their experimental protocols. In several cases, the description was overly simple, in such a way that it would have been difficult to reproduce the project. In other cases, some of the protocols were plainly not listed.

Next time this class is offered (Fall 2007), I plan to spend more time explaining how to better evaluate their evidence (data). I will use a few simple scientific articles to do so and will make it clearer what my expectations are (which I thought I had done...). I will also emphasize the importance of carefully reporting their experimentation protocol (materials and methods section). This will be needed in order to achieve a benchmark of 70-75% in this exercise.