Undergraduate Research Project
Biology 122 Lab (BIOL R122L)
2012-2013

Project ASCENCION
Oxnard College’s Title V STEM grant


Submitted to
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Title V STEM Director, Project ASCENCION

Prepared by
Myley Dang
Project ASCENSION (Articulating STEM Cooperatives to Enhance Needs, Success, Integration, Outcomes, & Networking) is a collaborative project at Oxnard College that has partnerships with the University of California at Santa Barbara (UCSB) and Oxnard Union High School District (OUHSD). Some of the primary goals of Project ASCENSION are to establish an early readiness and awareness for degrees in Science, Technology, Engineering, and Mathematics (STEM), as well as increase the number of Hispanic students entering community colleges and successfully transferring into four-year institutions.

Under Project “ASCENSION,” the Undergraduate Research Project involved students taking the Biology 122 lab (BIOL R122L) and exposing them to project-based learning. This class is a research-based lab that involved three phases, where students in the first phase learn about biology concepts and conduct in-lab research. In the second phase, students conduct on-site research in groups, while taking measurements and meeting with professionals in the field. In the third phase, students perform in-lab analysis and write a scientific paper. These activities were intended to engage students in a research project and have students produce their own product as scientists, while also exposing students to different types of career pathways. The immediate goals of this lab included developing students’ personal skills, interpersonal skills, and academic skills. The long-term goals included increasing students’ STEM career awareness and motivation, increasing students’ confidence and ability to work in groups, and increasing students’ academic success. The complete logic model of the Undergraduate Research Project is found in Appendix A.

The Undergraduate Research Project was evaluated using student self-assessments, student interviews, and instructor interviews. Student and faculty responses were assessed in this report and the results indicated that the students and faculty tended to respond favorably to most components of Biology 122L. Also, the students and faculty provided some suggestions on how to improve Biology 122L including offering more on-site visits to conduct research, providing more background on scientific writing, and making time available for student presentations.
Biology 122L (BIOL R122L) was offered during the Spring 2013 semester to integrate research-based learning into the classroom, where students engage in a three-part phase in the undergraduate research project. In the phase one, students learned biology concepts and conducted research in the lab. In phase two, students went on-site to conduct research in groups by collecting data, writing notes, and meeting with the scientists. In phase three, students performed analysis in lab including managing data, analyzing data, and writing a scientific research paper.

**COURSE OBJECTIVES**

The objectives of the research-based lab included students gaining knowledge of the following: concepts and applications in biological research; experimental versus descriptive science; hypothesis testing and experimental design; scientific writing; literature review and citation; statistical and graphic analysis; basic unifying concepts in biology; diversity of life in the Eukaryote; structure of basic systems in plants and animals; and identification methodology.

**CURRICULUM**

Biology 122L covered a number of topics including eubacteria and protista, fungi, plants, invertebrate zoology, and vertebrate dissections. Another component of the lab included research projects involving data collection at Ormond Beach, data analysis, developing figures and charts, and scientific writing.

**PARTICIPANTS**

During the Spring 2013 semester, there were 18 Oxnard College students enrolled in Biology 122L. A more detailed description of students’ major and plans to transfer will be discussed in the section describing student interviews.
PROTOCOL

This evaluation will provide information to help improve the Undergraduate Research Project in the future. Thus, this evaluation is a formative and summative evaluation – formative in the sense that the evaluation is being conducted for the purpose of program improvement and summative in the sense that the evaluation will examine how valuable Biology 122L was for students.

Accordingly, several instruments were administered as follows:

- Student Self-Assessment Forms (see Appendix B) – These forms were administered near the end of the semester to measure the development of students’ characteristics/skills as a result of participating in Biology 122L.
- Student Interview (see Appendix C) – Students were interviewed toward the end of the Spring 2013 semester to discuss their experience in the class.
- Faculty Interview (see Appendix D) – The course instructor, Dr. Lorraine Buckley, was interviewed after the semester ended.

This evaluation measures the implementation of the Undergraduate Research Project through the administration of student self-assessment forms, student interviews and faculty interview. The self-assessment forms include both closed-ended (i.e., Likert-scale items) and open-ended response questions and statements. Dr. Buckley was interested in assessing students’ interpersonal skills, intrapersonal skills, and academic skills and linking these specific skills to each of the three-part phases. The list of skills was developed by Dr. Buckley and the evaluation team to gain a better understanding of the extent to which these skills improved after the three-part phase.

All student self-assessment forms were in paper form and were completed toward the end of the Spring 2013 semester. A descriptive analysis of the Likert-scale items on the student self-assessment forms will disclose the degree in which the students’ characteristics/skills were affected by the project-based learning in Biology 122L. Open-ended questions and statements
elicit responses that can be used to understand which skills improved or did not improve, and in which ways these skills did or did not improve.

Student interviews were conducted toward the end of the Spring 2013 semester. Interviews were coded and analyzed based on common and unique themes. Dr. Buckley was also interviewed at the end of the Spring 2013 semester. Results from the student and faculty interviews suggest ways in which the Undergraduate Research Project could be subsequently improved in the future, and offer evidence of what went well, what did not go well, and reasons behind the perceived successes and shortcomings of BIO R122L.

ANALYSES AND RESULTS

The following protocol was used in conducting the analyses of student self-assessment forms:

1. Blank items were removed from the data set and these observations were coded as missing.
2. Items marked with an “X” were coded as “0” to distinguish the item from being missing.
3. Likert-scale scores were averaged for items in which the student provided more than one score.

STUDENT SELF-ASSESSMENT: DESCRIPTIVE STATISTICS

Of these 18 students, 17 students completed the student self-assessment forms. There was one student who filled out the form twice. It is unclear why this student filled out the form twice, but his responses were averaged across both self-assessment forms. Students were asked to reflect on their experiences from the Biology 122L course and assess the extent to which project-based learning (wetland/island project) improved their intrapersonal skills (i.e., critical thinking, problem solving, motivation, and ethics), interpersonal skills (i.e., leadership, teamwork, and communication), and academic skills. Students were asked to assess statements for each skill category using the following scale ranging from one through five, where one indicates Disagree Strongly, two indicates Disagree, three indicates No Opinion, four indicates Agree, and five indicates Agree Strongly. For the purpose of data interpretation, for students who “Agree” the responses four through five were collapsed. Similarly, for students who “Disagree” the responses from one through two were collapsed.
Table 1 displays students’ responses to the extent to which project-based learning improved their critical thinking and problem solving skills. The column labeled, “Marked,” indicates that a student marked an “X” without providing a number from one through five. The column labeled, “Agree – Agree Strongly (4.5),” indicates that a student filled out two self-assessment forms, where one form indicated “Agree (4)” and the second form indicated “Agree Strongly (5).” Thus the two responses were averaged to “Agree – Agree Strongly (4.5).”

Overall, students agreed that their critical thinking and problem solving skills increased as a result of participating in the project-based activities. There were 82.4% of students who agreed that their ability to think analytically and understand different points of views increased. Similarly, there were 76.5% of students who agreed that their ability to generate good ideas improved. There were also 94.2% students who agreed that their ability to apply knowledge to solve problems increased.

Table 1

*Intrapersonal skills – Critical Thinking and Problem Solving*

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Agree Strongly (5)</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Think analytically</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>5.9%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Generate good ideas</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Form opinions based on logic and facts</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>52.9%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Understand different points of view</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Apply knowledge to solve problems</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Be very attentive</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>52.9%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Formulate questions well</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>17.6%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Table 2 displays students’ responses to the extent in which project-based learning improved their motivation and work ethic. On average, students agreed that project-based learning improved their motivation and work ethic skills. There were 76.5% of students who agreed that their ability to work hard increased. This is similar for other statements including set and achieve positive goals (64.7% of students agreed), show initiative (76.5% of students agreed), organize one’s work well (70.6% of students agreed), and network/expand peer groups (88.2% of students agreed). There were 17.6% of students disagreed that their ability to work independently increased, while 23.5% had no opinion, and 47% of students agreed. However, 88.2% of students agreed that being very resourceful increased as a result of project-based learning.
Table 2

**Intrapersonal skills – Motivation and Work Ethic**

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>No Opinion–Agree (3.5)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Agree Strongly (5)</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work hard</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>11.8%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Set and achieve positive goals</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>23.5%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Show initiative</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>11.8%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Have good time management skills</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>23.5%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Work independently</td>
<td>5.9%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>23.5%</td>
<td>5.9%</td>
<td>23.5%</td>
<td>0.0%</td>
<td>23.5%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Organize one’s work well</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>17.6%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Be very resourceful</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>52.9%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Network/expand peer groups</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>5.9%</td>
<td>52.9%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
The next set of questions asked students to assess their ethics and integrity skills. Table 3 shows that on average, students agreed that their ethics and integrity improved as a result of participating in project-based learning in this course. In particularly, 88.2% of students agreed that showing respect for classmates had improved, and 94.1% of students agreed that showing respect for teachers had improved. In addition, 82.3% of students agreed that their ability to treat all people fairly increased. There were also 76.5% of students agreed that their ability to demonstrate responsibility has improved as a result of project-based learning, while 5.9% of students disagreed, and 11.8% of students had no opinion.

Table 3

*Intrapersonal skills – Ethics and Integrity*

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Agree Strongly (5)</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show respect for classmates</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>5.9%</td>
<td>52.9%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Show respect for teachers</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>64.7%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Be worthy of trust from others</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>5.9%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Be engaged in school activities</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>47.1%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Be engaged in community citizenship activities</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Treat all people fairly</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>52.9%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Demonstrate responsibility</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>11.8%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>70.6%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 4 displays students’ responses to statements related to persistence and resilience. Overall, students tended to agree that their ability to be persistent and resilient improved as a result of participating in project-based learning. In particular, 64.7% of students agreed that their ability to
remain calm under pressure improved after participating in project-based learning. There were mixed feelings about the ability to manage frustrations well, where 5.9% of students disagreed, 29.4% of students had no opinion, 47.1% of students agreed, and 11.8% of students strongly agreed. One possible explanation for this may be that students were not familiar to project-based learning and might have found it frustrating compared to the more “traditional” lab work and lab notebook assignments. Further analysis of these mixed feelings will be explored in students’ interview responses. There were 76.5% of students who agreed that their ability to overcome challenges and setbacks and 82.4% of students who agreed that their persistence improved.

Table 4

Intrapersonal skills – Persistence and Resilience

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>Agree (4)</th>
<th>Agree Strongly (5)</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remain calm under pressure</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>23.5%</td>
<td>41.2%</td>
<td>23.5%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Manage frustrations well</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>47.1%</td>
<td>11.8%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Overcome challenges and setbacks</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>11.8%</td>
<td>41.2%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Persistent</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>5.9%</td>
<td>35.3%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The results displayed in Table 5 shows that on average, most students agreed that their self-concept improved as a result of participating in the project-based learning. There were 70.6% of students who agreed that they were not anxious in the classroom/laboratory, with 23.5% of students who had no opinion. Most students agreed that they felt confident in themselves, where 76.5% of students agreed, 11.8% of students had no opinion, and 5.9% of students strongly disagreed. This result will be further explored in students’ qualitative responses to the self-assessment. It is important to note that 94.1% of students agreed that they value their personal contribution to the team. Since this course involved a lot of collaborative work, it is reasonable
that students value their contribution to the group. In addition, 88.2% of students also agreed that they had a better understanding of Science, Technology, Engineering, and Mathematics (STEM).

Table 5

_Intrapersonal skills – Self-Concept_

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Agree Strongly (5)</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not be anxious in the classroom/laboratory</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>23.5%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Feel confident in myself</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>11.8%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Value my personal contribution to team</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>64.7%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Have a better understanding of STEM</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>5.9%</td>
<td>52.9%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The next two tables display the results from students’ interpersonal skills. As shown in Table 6, on average, students tended to agree that their leadership and teamwork skills had improved. Most students agreed that they were able to handle different social situations, where 88.3% of students agreed to this statement. Students felt that their ability to work well in group settings and their ability to appreciate the perspectives of others improved, where 88.2% of students agreed, and 5.9% of students disagreed to each statement. Most students agreed that they their ability to give helpful criticism/feedback to others (82.4% of students agreed) and their ability to interact well with colleagues/professionals (94.1% of students agreed) improved. In terms of diversity, 70.6% of students agreed that their ability to be culturally sensitive improved, 17.6% of students had no opinion, and 5.9% of students strongly disagreed. Similarly, there were 70.5% of students who agreed that their ability to embrace diversity increased, while 17.6% of students
had no opinion and 5.9% of students strongly disagreed. These results will be further explored in the qualitative analysis of students’ responses.

Table 6

*Interpersonal Skills – Leadership and Teamwork*

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Agree Strongly (5)</th>
<th>Missing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handle different social situations</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>35.3%</td>
<td>5.9%</td>
<td>47.1%</td>
<td>5.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Work well in group settings</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>5.9%</td>
<td>64.7%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Appreciate the perspectives of others</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>5.9%</td>
<td>64.7%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Give helpful criticism/feed back to others</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>11.8%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Interact well with colleagues/professionals</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>29.4%</td>
<td>5.9%</td>
<td>58.8%</td>
<td>0.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Be culturally sensitive</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>23.5%</td>
<td>5.9%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>100%</td>
</tr>
<tr>
<td>Embrace diversity</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>17.6%</td>
<td>0.0%</td>
<td>52.9%</td>
<td>5.9%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 7 displays students’ response to statements related to their communication skills. Overall, students tended to agree that their communication skills improved as a result of project-based learning. More specifically, 64.7% of students agreed that their ability to write essays well improved, while 23.5% of students had no opinion. There were 88.2% of students who agreed that their ability to express ideas clearly in short written text improved. There were mixed feelings in terms of expressing ideas clearly in oral presentations, where 23.5% of students disagreed, 29.4% of students had no opinion, and 41.4% of students agreed to the statement. It is interesting to note that despite the mixed feelings about expressing ideas clearly in oral
presentations, most students agreed that their ability to get the point across effectively in conversations and discussions improved. There were 76.5% of students who agreed, with 17.6% of students who had no opinion.

Table 7

*Interpersonal Skills – Communication Skills*

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>No Opinion–Agree (3.5)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Agree Strongly (5)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write essays well</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100.0%</td>
</tr>
<tr>
<td>Express ideas clearly in short written text (emails, notes, memos)</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>23.5%</td>
<td>5.9%</td>
<td>58.8%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Express ideas clearly in oral presentations</td>
<td>5.9%</td>
<td>5.9%</td>
<td>17.6%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>5.9%</td>
<td>17.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Get point across effectively in conversations and discussions</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>17.6%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 8 displays students’ responses to statements related to their academic skills. Overall, most students agreed that their academic skills improved as a result of participating in project-based learning. Most students agreed to strongly agreed that their ability to read scientific literature, conduct literature reviews, collect data, manage data, analyze data, interpret data, and produce data improved. In addition, 82.3% of students felt that they were more aware about career paths and opportunities. Most students also agreed that they knew more about natural communities, ecological concepts, plant identification and animal identification as a result of the wetland project. There were a few students who disagreed to some statements including conducting literature reviews, building a scientific bibliography, writing in a scientific format, writing in a scientific style, managing data, and being more aware about career paths and opportunities. One possible explanation why these students might have marked “disagree” might be because they
felt they were already aware or knew how to write in a scientific format before taking this class. This possibility will be explored in more depth in the qualitative, open-ended responses.

Table 8

*Academic Skills*

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

<table>
<thead>
<tr>
<th></th>
<th>Marked without Ranking (0)</th>
<th>Disagree Strongly (1)</th>
<th>Disagree (2)</th>
<th>No Opinion (3)</th>
<th>Agree (4)</th>
<th>Agree – Agree Strongly (4.5)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read scientific literature</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Conduct literature reviews – (e.g., finding scientific papers)</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>11.8%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Build a scientific bibliography</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>29.4%</td>
<td>11.8%</td>
<td>0.0%</td>
<td>47.1%</td>
</tr>
<tr>
<td>Conduct the scientific method</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>11.8%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>35.3%</td>
</tr>
<tr>
<td>Write in a scientific format (e.g., introduction, methods, results, discussion)</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>47.1%</td>
</tr>
<tr>
<td>Write in a scientific style (e.g., past tense, no modifiers, few words)</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>11.8%</td>
<td>29.4%</td>
<td>0.0%</td>
<td>47.1%</td>
</tr>
<tr>
<td>Collect data</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>52.9%</td>
</tr>
<tr>
<td>Manage data (e.g., cataloging data, data cleaning)</td>
<td>5.9%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>0.0%</td>
<td>35.3%</td>
<td>0.0%</td>
<td>52.9%</td>
</tr>
<tr>
<td>Analyze data</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>47.1%</td>
</tr>
<tr>
<td>Interpret data</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>11.8%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Produce data graphics/figures</td>
<td>5.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>11.8%</td>
<td>23.5%</td>
<td>0.0%</td>
<td>58.8%</td>
</tr>
<tr>
<td>Present one’s work using various media</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>23.5%</td>
<td>41.2%</td>
<td>0.0%</td>
<td>29.4%</td>
</tr>
<tr>
<td>Communicate with scientists</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>47.1%</td>
<td>0.0%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Be more aware about career paths/opportunities</td>
<td>0.0%</td>
<td>0.0%</td>
<td>5.9%</td>
<td>17.6%</td>
<td>0.0%</td>
<td>64.7%</td>
<td>5.9%</td>
</tr>
</tbody>
</table>
The following section will discuss the open-ended responses on the student self-assessments. Common and unique themes will be presented in the following section.
STUDENT SELF-ASSESSMENTS: OPEN-ENDED RESPONSES

Students had the opportunity to add comments on the open-ended responses on the student self-assessments. Since this evaluation is focused on the improving the class, common and unique responses from students’ responses are highlighted below.

1. **Based on your experiences in this class, what skills do you believe has improved the most?**

- Some common responses from the students include the following (misspellings are preserved):
  - Data collection and data analysis
    - “Being able organize data and being able gather data while on the field”
    - “We were able to gather and interpret data to provide valuable information.”
  - Group work/ Teamwork
    - “I believe my abilities to work with others and voice an opinion in a group has improved.”
    - “Based on my experience in this class I feel that my teamwork skills have improved the most.”
    - “Being able to work in a group and analyze each persons perspective.”
  - Presentation Skills
    - “Presenting it to classmates and students at CSUCI provided an invaluable experience in that we honed oral interpersonal skills while being introduced as respected members of the academic world. This allows for a boost of confidence in my presentation skills and overall standing in science.”
    - “I believe that I have improved in public speaking.”
  - Scientific skills and scientific writing
    - “Working in teams, analyzing data with classmates and writing scientific papers.”
“Scientific skills such as collecting data, writing in a scientific format, analyzing data and build a report upon it.”

- Some unique responses from the students include the following (misspellings are preserved):
  - “Biology 199 has provided a plethora of insight into the subject as a career.”
  - “Many of the questions above I gave a "2" only because I feel that those skills were obtained in previous classes, and not "improved" upon during this course. What improved most was community awareness and Biology research.”
  - “Interacting with other faculty”
  - “Critical thinking”

Most students articulated that their skills in data collection, data analysis, working in a group, team work, presentation, and scientific writing improved the most. The unique responses revealed that one student believed this class opened their career pathways, while another student felt that most of these skills in the self-assessment form were already obtained from other classes and were not improve. Other students mentioned that interacting with faculty and being able to communicate was a skill that improved. Another student responded that critical thinking skills improved as a result of this class. The ways in which these skills improved are discussed in the next section.

1a. In what ways have these skills improved?

- Some common responses from the students include the following (misspellings are preserved):
  - Data collection and data analysis
    - “Taking better notes”
    - “Now I know what field research is and how to collect this kind of data.”
    - “More efficient”
    - “This skill has greatly improved because of the intense surveying that we did.”
  - Group work/ Team work
During our projects we must decide who does what, It encourages me to be a team player.”

“My teamwork skills have improved by learning how to communicate and reach a group consensus in order to solve a problem.”

“after the first visit to Ormond, we/I realized how different or data was. It took time to coordinate, organize and interrupt that data. If taken to Ormond again, I think we could have devised a great plan of attack on gathering data. Coming up with ways to solve problems has improved. Working in a group has improved.”

Presentation Skills

“After every practice session I noticed my speaking becoming more fluid, I sometimes struggle with stammering and stuttering. I became less anxious as I became more confident and in control of the situation. As a result of my experience in 199 I am more willing to jump into biology as a career.”

“I am able to speak more clearly and get my point across when speaking in a public setting.”

Confidence

“I feel more confident giving my opinion.”

“Being more social in a scientific inquisitry has helped me be more confident in my opinion.”

Scientific skills and scientific writing

“Understand and format”

“Participation in class discussions and writing portions of the research paper.”

“By being able to write more fluid a scientific paper and giving me an insight of how it is to work in a scientific team.”

Some unique responses from the students include the following (misspellings are preserved):
“Previously thought of Biology as rote-memorization. Now I use the concepts I learned to answer open-ended questions”
“Being able to hold a conversation”
“Observation through field trip labs”

Students provided various comments on ways in which their skills improved as a result of taking this class. The most common responses included improvement in data collection, data analysis, working in a group, presentation skills, confidence levels, and scientific writing and scientific skills. Some students felt their note-taking skills improved and their ability to communicate with their team increased. Some students expressed their confidence levels and presentation skills increased and their ability to write a scientific paper improved. These are important findings as it suggests that students felt that the class improved the skills for some students. For other students, however, there were skills that were not improved. This will be discussed in the following section.

Students were asked to describe the skills in which they believed did not improve based on their experiences in this class. Common and unique responses from students’ responses are highlighted below.

2. Based on your experiences in this class, what skills do you believe has not improved?

- Some common responses from the students include the following (misspellings are preserved):
  - Data analysis techniques
    - “Excel techniques”
    - “Formating figures”
    - “My ability to interpret other's work has not improved.”
  - Reading/writing skills
    - “The ability of reading scientific literature.”
    - “My writing skill”
    - “Writting essays has not improved (scientific wrinting).”
    - “Writing scientific papers, gather research, working in teams.”
  - Presentation skills
• “Speaking in front of the class.”
• “Verbal/oral presentation”

- Some unique responses from the students include the following (misspellings are preserved):
  - “There are no skills that I feel have not improved. This class has been a great learning experience and in one way or another has helped me to improve in many different ways.”
  - “none, this class was great.”
  - “I feel that my hands-on experience could have improved more.”
  - “Personal and cultural diversity and setting goals”

Some students felt that their data analysis techniques, reading and writing skills, and presentation skills did not improve after this class. Students expressed that their ability to format tables in excel or their ability of reading scientific literature or write scientific papers did not increase after this class. Some students also believed that their oral speaking skills did not improve. For some students, writing skills were improved, but for other students, they did not feel their writing skills improved. Although there were some students who mentioned some skills that did not improve, there were some students that felt otherwise. Under the unique responses, one student believed the class had helped the student improve in many different ways, while another student mentioned that there were no skills that did not improve and that the class was great. In addition, there were other students who felt there could have been more hands-on experience opportunities. These suggestions will be discussed in further detail in the discussion and recommendations section.

Students were asked to describe ways in which these skills have not improved. Below are common and unique responses from students’ self-assessment forms.

**2a. In what ways have these skills not improved?**

- Some common responses from the students include the following (misspellings are preserved):
  - Data analysis techniques
Most students stated they already had skills in data analysis, writing scientific papers, gathering research and working in teams prior to taking this class. In terms of reading and writing skills, students believed that the format could have been clearer and that they could have improved in reading scientific papers. One unique response from a student suggests that there could have been more hands-on experience opportunities instead of spending a lot of time working on larger group projects. These suggestions will be discussed in further detail in the discussion and recommendations section.
Other Comments

- Some common responses from the students include the following (misspellings are preserved):
  - Enjoyed the class
    - “This was such a fantastic experience. I enjoyed the subject of the research and working with Cera and Dr. Buckley. Being able to actually “do Biology” is something I now look forward to.”
    - “Class was super fun I just wished we spent more time outside during the lab”
    - “Best biolog course I have taken in a while, mainly because of the field learning at Ormond Beach. Definitely would reccomend!”
  - Field trips/field work
    - “The trips were awesome, made me learn a lot and had me rethink career”
    - “The field work was fun after getting used to the change in work from a lab style, but after a while of work it did feel like it dragged on a bit, but overall it was a positive experience.”
  - Data collection/data analysis and group work
    - “It may be beneficial for the class to come up with a plan for gathering information/data prior to going into the field, i.e., first decide on a question the class should answer and then decide, as a class or in smaller groups, how they're going to find the answer. This includes having people decide how to gather and analyze data. It makes people think about the entire process and the best way to approach finding an answer to a question. Not to mention you have to work as a team which is frustrating and a lot like real life.”
- Some unique responses from the students include the following (misspellings are preserved):
  - “I appreciate the experience of working along side with trained scientists. I also enjoyed the fact that the research leaders (Dr. Buckley and Tom McCormick) asked for our opinions and let us have a say in how the research was conducted.”
That results in a boost of confidence for a student like me. It is important that they did not shout out orders but instead provided us with guidance.”

- “This lab requires a lot of time and work for 1 unit and is a great stepping stone for research opportunities at the university level.”
- “More classes should have research projects!”

The students’ open-ended responses in the comments section suggest that although the Biology 122L class was perceived to be a success for some students, there is room for improvement. For instance, many student comments indicated that the lab was great overall. Students enjoyed the class overall, especially the trips to Ormond Beach and conducting field work. However, there were also specific recommendations on how to improve the Biology 122L class. One student suggested having groups to discuss data collection procedures prior to entering the field. That way, students can be more prepared and know what to do when they are conducting field work. Another student suggested that more classes should include research projects. More recommendations on how to improve the event will be discussed in the conclusion and recommendations sections.

The following section examines the responses from the student interviews.

**STUDENT POST-INTERVIEWS**

Towards the end of the Spring 2013 semester, students were asked to participate in a 30-minute interview to discuss their experience in the class. There were 15 students who participated in student interviews, two of which were interviewed at the same time due to schedule conflicts. As seen in Table 9, of the 15 students who were interviewed, 40.0% of students majored in biology, while 6.7% of students each majored in biochemistry, biological sciences, computer science, marine biology, neuroscience pharmacology, and pre-dental. There were 13.3% of students who majored in pre-physician assistant.
Students were asked if they planned to transfer to a four-year college or university. As displayed in Table 10, 20% of students have already been accepted to a four-year college or university and will start this Fall 2013 attending schools including UC Santa Cruz, UC Santa Barbara, and CSU Channel Islands. There were 33.3% of students who planned to transfer next Fall 2014, and one student (6.7%) did not provide an expected transfer date, but indicated plans to transfer as soon as his/her prerequisites were completed. Lastly, there were 40% of students who have already received their bachelor’s degrees and were taking classes at Oxnard College to satisfy pre-requisites for graduate or professional schools including a graduate degree in computer science, medical school, dental school, and physician’s assistant school.
Table 10

*Transfer plans*

<table>
<thead>
<tr>
<th>Transfer Plan</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Already accepted, will attend college/university in Fall 2013</td>
<td>3</td>
<td>20.0%</td>
</tr>
<tr>
<td>Will transfer in Fall 2014</td>
<td>5</td>
<td>33.3%</td>
</tr>
<tr>
<td>Will transfer once prerequisites are completed</td>
<td>1</td>
<td>6.7%</td>
</tr>
<tr>
<td>Will not transfer, already have Bachelors degree</td>
<td>6</td>
<td>40.0%</td>
</tr>
</tbody>
</table>

*Students’ Overall Experience in this Class*

Overall, students enjoyed the class and felt that it was different from any other traditional “cookie cutter” lab class they had taken previously. Students mentioned that in usual lab classes, there is a textbook that you read, you follow it, and you fill in the blanks and perform “cookbook” type of experiments. Students felt they had a unique opportunity to do research in the field and to experience what it is like to be a biologist and see how field work is performed. Most students enjoyed being outdoors and being in the field to collect data. Some students felt it was a great research opportunity as it allowed them to be out in the field with professors “doing the same thing” as them where “you feel like you’re at the same level,” and they are teaching you differently than what you would get in the classroom. Students were very impressed with Dr. Buckley’s interest, level of enthusiasm, mentoring skills, and her welcoming nature, which made students feel comfortable especially on the first day of class. Some students mentioned that they saw Dr. Buckley more as a colleague than a teacher with authoritative power because she gave the students autonomy to collect their own data. Other students mentioned that Dr. Buckley emphasized research and encouraged students to do internships in the future.

In addition to the field work, most students also enjoyed the dissections. There was one student who did not like the dissections and did not feel comfortable being around the smells of formaldehyde. For the most part, however, students seemed to enjoy their experience in the class.
What did you like most about this class?

Most students seemed to enjoy having Dr. Buckley as a teacher and getting hands-on experience in the field. Students enjoyed how Dr. Buckley emphasized understanding the material rather than memorizing it. Students also liked how Dr. Buckley spent time explaining how the research should be done and encouraged students to be curious about biology. Most students also mentioned enjoying going on field trips and working together as a team. Students enjoyed being outdoors and working side-by-side with the instructor and interacting with other people. One student in particular, stated that what he enjoyed the most was seeing how their work could have an impact, seeing where the data came from, and how the actual responses were taken into account.

How do you think Bio 122L can be improved when this course is taught in the future?

When asked how the course can be improved when taught in the future, students offered four suggestions overall. First, students unanimously agreed that having more field days and more observations over the course of the semester would be a nice improvement to the course. One student emphasized making the Channel Islands field trip mandatory because it would give students an opportunity to see the natural resources. Second, students offered some suggestions on how to improve the projects. Students would like to be more informed prior to going to the field in terms of what is expected of them, and the type of work that would be conducted in the field. Some students suggested having more scientists in the field and having more consistency throughout the project. Third, some students were not comfortable with dissections on animals. One student suggested having the dissections be less pungent, which might make the dissections in the lab more comfortable. Fourth, students would like to have seen better organization throughout the semester. Students mentioned that they liked knowing what is expected ahead of time. For example, one student mentioned that the syllabus was altered verbally and the syllabus was never updated, thus making the expectations unclear. Some students also suggested having the logistics of getting onto the site more organized and being better prepared on how to conduct field work prior to going on site. Overall students would like to have expectations more clearly explained and/or written down.
What are the different types of career pathways that you have learned in this class (e.g., guest speaker, meeting with professionals)?

In this Biology 122L class, students had many opportunities to learn about the different types of career pathways. Some students mentioned that on the first day, Dr. Buckley discussed the different career pathways for students majoring in biology including being a physician assistant, dental assistant, traveling nurse, teacher, and researcher. Students also stated that Dr. Buckley encouraged students to apply for internships and meet with the experts in the field to understand whether their research aligned with the field they were considering. In addition, the field trips provided students with an opportunity to meet different scientists including botanists, ornithologists, ecologists, and field conservationists. One student stated that this class broadened their career aspects and she learned what it was like to do research.

What are the different types of research skills that you have learned in this class (e.g., field work, in-lab research, literature review)?

Overall, in terms of research skills, students stated that they learned how to work in a group, collect data, and write a research paper. Students mentioned that the ability to work in a group was a key research skill to learn because there were many opportunities to work in a group, and students were able to work well with others. One student stated that when instructors asked for the students’ opinions, this made the student feel more involved and the relationship felt more like that of colleagues. Other students remarked that they had become more comfortable with writing a research paper, specifically writing the abstract and methods section. Students also commented that they became more familiar with displaying results in various graphs and charts.

How did working in a group for your project enable you to engage in the following aspects of research?

Students worked together to collect data, analyze data, and write up the research report. In terms of collecting data, students remarked that they collected a lot of data to get as accurate information as possible and to verify their findings. Students also divided up the tasks and get a group consensus on who is responsible for doing which tasks. Some students enjoyed working in groups because it allowed them to share their ideas openly and see different perspectives from their group members. In terms of analyzing data, students developed figures and tables to display
the results of their data. Students shared their figures with the class and the class narrowed down to six figures to use in the final research report. Students mentioned that sharing the data results in this manner was very helpful because students were able to compare and contrast the different results among groups. In terms of write ups, students worked in groups to exchange their notes and emailed each other if they had any questions. There were certain sections of the write ups that were written as a whole group including the methods and results section. Other sections, including the introduction and conclusion, were written up by the individual student.

Did you have opportunities to interact with colleagues?

Students had the opportunity to interact with the colleagues, professors and scientists. As mentioned before, students worked with their colleagues in their groups to collect data, develop figures, ask questions, study together, and write certain sections of the report.

Did you have opportunities to interact with mentors?

There were no mentors in the class besides a tutor from the STEM Center; however, most students mentioned they did not seek tutoring services. There was also one student, who previously took the class, who came in to show the class a video that provided students an idea of what to expect in the field.

Did you have opportunities to interact with professors?

Students stated that they mostly interacted with Dr. Buckley in the classroom, but also had opportunities to ask Dr. Buckley questions in the field. One student remarked that the experience of doing field work with your professor rather than having the professor lecture provides a closer relationship, and you gain more respect for your teacher because you see them utilizing your knowledge. Students saw Dr. Buckley more as a mentor than a professor. Students said that Dr. Buckley was very approachable and answered any questions they had. Students mentioned that Dr. Buckley was also available to answer questions via email. One student attended Dr. Buckley’s office hours and found it to be helpful.
Did you have opportunities to interact with scientists?

Students also had the opportunity to interact with a variety of scientists in the field including a biologist, botanist, ornithologist, and ecologist. Students enjoyed interacting with these scientists and getting a sense of what it means to do research in their field.

To what extent do you feel this class has increased your STEM career awareness?

Overwhelmingly, students felt that this class definitely increased their STEM career awareness. Students expressed that they were exposed to many different job opportunities in the field of biology besides being a biology teacher. More specifically, one student remarked that it showed her that the biology major is not just working in the lab, but also working in the field, through ecology, ornithology, botany, and environmental science. Another student said that it exposed him to field research and provided a brief introduction to what he would be doing if he were to follow the biology path. One student commented how she was familiar with the physical side of STEM, but taking this class increased her awareness on the biological side of STEM. The class allowed her to think like a biologist, and how the different methods used in biology can be helpful in different STEM fields.

Students also mentioned that since Dr. Buckley highly stressed its importance of internships, this class increased their awareness of different internship opportunities. Students also became more aware of other students’ majors in the class and stated that they did not know about other careers involving biology such as a physicians’ assistant or dental assistant.

To what extent do you feel this class has increased your motivation to pursue a STEM career?

Some students felt that taking this class did not necessarily increase their motivation to pursue a STEM career because they had always wanted to study STEM. Nevertheless, these students mentioned that this class might have strengthened their decision to pursue a STEM career. Other students reported that this class increased their motivation to go to dental school and medical school. One student mentioned that this class had a big influence and made him rethink what he wanted to do as a career. More specifically, this student mentioned that the biggest influence was “being out there in the field” and understanding that “biology isn’t just textbooks,” but rather “you can go out in the field.” This class changed the students’ perceptions of what it means to be
a biologist. That is, biologists do more than wear lab coats and run experiments in the lab, but rather, conduct research in the field and work with different plants and animals in various environments.

Another student added that this class had definitely increased their motivation to pursue a STEM career because “lecture sometimes seems, honestly, just kind of boring, like you’re just memorizing facts, and I was just getting bored with the class. But the lab really made me get more interested in the class because this is what you really do, and you’re not just like reading a book and memorizing things. You actually get to go outside. I don’t know they seem like fun projects to me.” The experience that students gained from the project-based learning proved to change some students’ perceptions, while increasing some students’ motivation to study STEM and pursue a STEM career.

*To what extent do you feel this class has increased your confidence (i.e., knowing how to present one’s self, collecting data, analyzing data, reporting data, etc.)?*

Every student that was interviewed indicated that their confidence level increased after taking this class. More specifically, one student mentioned that “the experience of research makes me more knowledgeable. I feel safe talking about it, and knowing what you’re talking about.” Students felt more confident expressing their opinions in working with their groups. In addition, several students commented on feeling more confident in writing a research paper.

*To what extent do you feel this class has increased your networking (i.e., study partners, knowing how to network/ expansion of peer group)?*

In terms of networking skills, students remarked that they were able to network with their colleagues by exchanging contact information to form study groups and collaboratively work on the research report. Students also mentioned they were able to network with the other scientists, guest speakers and professionals in the field. One student commented that he felt he could network with Tom McCormick, who is the other biologist in the field, and “work as an intern if I wanted to.” Overall, it seems that students developed their networking skills after participating in this class.
To what extent do you feel this class has increased your probability/likelihood of transfer to a four-year university?

There were mixed results in terms of whether this class increased students’ probability/likelihood to transfer to a four-year university. For some students, this class did not necessarily increase their probability or likelihood to transfer because they already possessed the motivation to transfer even prior to taking this class. For other students, this class did increase their likelihood to transfer. In particular, one student remarked that this class served as “a stepping stone to getting me closer to transferring.” Similarly, another student commented that this class allowed them to “meet people who have the same goals,” thus further increasing their networking skills and expanding their peer groups. Another student commented that “I’m more determined. I like the work and I like the biology aspect even more now,” which shows that this class increased their motivation to transfer and study biology.

Based on the responses from the student interviews, it is apparent that students enjoyed the class and developed their research skills, while increasing their confidence in conducting research, analyzing data, and writing reports. Students also felt comfortable working in groups and expressing their ideas to one another. A more detailed discussion of students’ responses will be provided in the discussion section.

The following section examines the responses from the faculty interview.

FACULTY INTERVIEW

Dr. Buckley was also asked to participate in a one-hour interview at the end of the course. Her responses are summarized below.

Overall experience teaching Bio 122L

Dr. Buckley expressed that she enjoyed the class, but noted that combing the Biology 199 and 122L into one class was a lot. She recommended that for the future, it would be better to separate the class and have the 122L class meet six hours a week during the regular semester and have a separate 199 class during the summer. Dr. Buckley also noted that she enjoyed having students who were in science-related fields because they were more prepared to take the class since they had at least two years of math and science and were “eager to be scientists.”
What did you like most about teaching this Bio 122L class during the Spring 2013 semester?

Dr. Buckley remarked that she liked seeing the students “excited to come to class, eager to get going, and engaged in the project.” She also enjoyed teaching this class to upper division students because they were more active and asked questions, which showed their interest and motivation for the class. She commented that in lower division classes, students tended to rely on the instructor as to what to do and how to do it, whereas upper division students were more self-motivated and pursued their own directions for the topics they were studying.

In what ways did you find teaching Bio 122L this year (Spring 2013) different from last year (Spring 2012)?

The major difference that Dr. Buckley noted between this Spring 2013 class compared to last year’s class was the students’ level of engagement and motivation. Dr. Buckley commented on how the students were more engaged and independent in doing their projects this year. This might have partially been due to the fact that students were divided into groups and worked collaboratively with one another. They “relied more on each other” and “created stronger bonds” with one another. Dr. Buckley noted that hopefully this collaboration and relying on each other translates to success in the other upper division courses.

What are the different types of career pathways and research skills that you believe students learned in this class?

Dr. Buckley noted that students were exposed to different career paths oriented toward government work including environmental agencies and non-profit groups. There was also a guest speaker, Steve Norris, from Cal State Channel Islands (CSUCI) who talked about a career path toward conducting research at the university level.

In terms of research skills, Dr. Buckley believed that students developed skills in reading and writing a literature review; performing hypothesis testing and designing experiments; making decisions as a group; managing data; using different computer software such as Excel; writing in a scientific style; and writing in a collaborative manner.
How do you think working in a group for the class project enabled students to engage in collecting data, analyzing data, write ups, and presentations?

Dr. Buckley mentioned that initially, students were surprised that their data would be used by their group members, which consequently forced students to rethink how to collect data and represent it a manner that was helpful for their groups. In terms of analyzing data, students were responsible for working on figures and sharing it with the class. Dr. Buckley mentioned in doing so, students had an opportunity to see what kinds of figures students can do as a group and see what other types of analyses other groups performed with their data. This collaborative nature allowed students to openly share their ideas with the groups and with the rest of the class. Another collaborative effort involved writing the methods section since all of the students were together in the field and can discuss how they collected their data and how they chose to analyze their data. Students were responsible for writing the paper in a scientific format including the introduction, methods, results, discussion, and literature cited. There were no presentations in the class due to time constraints. For the future, Dr. Buckley recommends reserving some time for students to present their figures before the final so students would have a better understanding of the analysis before writing up the final report. Other recommendations will be offered in the conclusion and recommendation section.

Did student have opportunities to interact with colleagues, mentors, professors, and scientists?

Dr. Buckley stated that there were many opportunities for students to interact with colleagues, professors and scientists. There were no mentors in the class. Originally, Dr. Buckley wanted to have the 199 students who have already completed this project, come to the 122L class, however their schedules conflicted with the lab times, and thus the students did not have an opportunity to interact with mentors. Dr. Buckley mentioned holding office hours for students, but noted that only two students utilized the office hours. In terms of interacting with scientists, there were plenty of opportunities to work with the scientists in the field, where every student had a chance to work with at least three professionals. Dr. Buckley commented that she felt students felt “empowered to do things and ask questions,” thus confirming the level of independence among these students.
To what extent do you feel this class has increased students’ STEM career awareness, motivation to pursue a STEM career, confidence, networking skills, and probability/likelihood of transferring to a four-year university?

In response to these questions, Dr. Buckley mentioned that most students did not have previous experience with non-profit research nor were they aware of the different career pathways in biology. This class not only increased students’ STEM career awareness, but also changed students’ perspective about environmental restoration. Dr. Buckley also noted that after the class, all students intended to stay in a science-related career. In addition, she mentioned this course increased students’ confidence in conducting field data research and increased their computer skills. In terms of networking skills, she noticed that students did not understand how to work with others at first; however, by the end, students saw the advantage of working together to share ideas and were able to collaborate with one another on their projects. Dr. Buckley also commented on students’ probability/likelihood of transferring and noted that all students were going to transfer anyway, but she felt this class increased their potential success – that is success in their grades and self-confidence.

How do you think Bio 122L can be improved when the course is taught in the future?

Dr. Buckley offered several recommendations to improve the course when it is taught in the future. First, she recommended reducing the class size from 19 to about 15 to 16 students. Second, she advises to change the curriculum by combining lecture and lab so students can attend both instead of one or the other. Third, Dr. Buckley recommended gathering groups of students into the classroom before going into the field. She suggested having each group give 15-minute mini-presentations of who they are, what they do, what their research interests are, provide their contact information, and pose questions to the rest of the class. In doing so, this would allow students to become more familiar with each before going onto site. Fourth, Dr. Buckley recommended having the Biology 199 class as a follow-up course to the Biology 122L. Fifth, she recommended working with professors in the earlier course sequences to plan activities that will prepare students for the Biology 122L class. For example, she recommended having students conduct literature reviews in the 120 class, where students can write up details about the project and gain experience in doing literature reviews before getting to her class. Additional recommendations will be discussed in the conclusion and recommendation section.
What were some of the challenges you faced in teaching this course during the Spring 2013 semester, if any?

Dr. Buckley indicated that the class size and group dynamic were challenging, and she felt that students might not have enough time to check in with each group. She also noted that there were challenges that were out of her control including the lack of rainfall and encountering endangered species that required a permit. She mentioned that this was good for students to see because they had an opportunity to see real life experiences in the field.

How do you plan to address these challenges when this course is taught in the future?

To address these challenges, Dr. Buckley plans to reduce the class size and incorporate some group activities such as the group introduction min-presentations (as previously mentioned) and team building exercises to introduce the idea that students will be working in a group. As far as time goes, Dr. Buckley wants to limit her Biology 199 class to the summer so she can have more time to work with students. In terms of the permit for endangered species, she has already applied for the permit and is waiting for approval.

Other comments

Dr. Buckley added that project-based learning is very interdisciplinary and that most labs are not presented in this way. She also noted that that the idea of evaluation is new to her and forced her to think about concepts that she has not thought about before.

DISCUSSION

Students and faculty tended to have favorable perceptions of the Biology 122L class as measured by the student self-assessments, student interviews, and faculty interview. In examining the descriptive statistics of the self-assessment, it seems that most students’ intrapersonal skills, interpersonal skills, and academic skills improved by partaking in project-based learning in the Biology 122L course. More specifically, most students’ ability to think critically and solve problems improved. Most students agreed they experienced an increase in their motivation and work ethic. Some students had no opinion on whether their time management skills and/or ability to work independently increased. Nevertheless, most students agreed that their ability to work hard, set and achieve positive goals, and network improved as a result of participating in this
class. Most of the students also demonstrated ethics and integrity in the course by showing respect for their classmates and instructor, treating people fairly, and being responsible in the class.

Over half of the students felt they exhibited persistence and resiliency in the class by keeping calm under pressure, managing frustrations well, and overcoming challenges and setbacks. Many of the students also felt they had developed their self-concept. In particular, students felt more confident and they valued their personal contribution to the team. In terms of leadership and teamwork skills, most students agreed that they worked well in group settings, appreciated the perspectives of others, and interacted well with their colleagues and professionals. Students also felt they have developed their communications skills, especially in their ability to write essays well and express ideas in a short written text. However, in terms of oral presentations, students expressed mixed opinions, where a third of the students disagreed, a third had no opinion, and another third agreed they were able to express their ideas clearly in an oral presentation.

Many of the students felt that their academic skills improved as a result of participating in this project-based learning opportunity. In particular, students tended to agree that their ability to read scientific literature, conduct literature reviews write in a scientific format and scientific style, manage, analyze and interpret data improved. In addition, many students agreed they were more aware about career paths and opportunities and knew more about natural communities, ecological concepts, plant identification and animal identification as a result of the wetland project.

An examination of the students’ open-ended responses confirmed the results from the descriptive analysis of the self-assessment items. The responses showed the most improvement in students’ ability to collect data, analyze data, work in groups, write scientifically, and present their work to others. Some students argued that their data analysis techniques and reading and writing skills did not improve after taking this class. In response to the ways in which these skills had not improved, a few students mentioned that they already possessed these skills and therefore did not believe that the skills improved. Another student commented on how the format should be clearer, which may help the student improve their reading and writing skills. Overall, students commented on how much they enjoyed the class, especially the field trips and field work. Students also enjoyed working in groups to collect and analyze data.
These responses are confirmed in the responses from the student interviews. The results from the student interviews indicated that overall, the students had a positive experience in the class. Students replied that they enjoyed the hands-on experience doing field work and seeing how their work can have an impact on the environment. Students also emphasized that this class is very different from the traditional lab classes, as this class was a great research opportunity and allowed students to interact with scientists in the field.

The instructor also enjoyed the class and enjoyed having students who were motivated and eager to do research. Dr. Buckley also noted that she believed the students gained research experience and developed skills in reading and writing a literature review, working in a group, managing and analyzing data.

The students and the instructor also offered some recommendations on how to improve this course for the future. These recommendations will be discussed in the conclusion and recommendations sections

LIMITATIONS AND BARRIERS

There were some limitations that affected the interpretation of the self-assessments data and interview responses. First, there was one student who completed two self-assessments and instead of using the latest form, the responses to the self-assessments were averaged. It is recommended to include a date on the self-assessment form to know which form is the most current in case this happens in the future. There was also one student who marked an “X” instead of responding with one through five. Perhaps the ranking should be bolded or listed one through five so students choose which response best suits them instead of writing one through five. This will be further discussed in the conclusion and recommendations section.

Second, not every student was interviewed individually due to time constraints. There were two students who signed up for the interview but did not show up. In addition, two students showed up at the same time during one interview slot, resulting in a group interview instead of a one-on-one interview. It is possible that being in a group interview might have persuaded the students’ responses one way or the other, which might affect the interpretation of the students’ responses.
Finally, another limitation is the administration of the self-assessment forms. Due to schedule conflicts, Dr. Buckley administered the self-assessment forms to the students. It is recommended that the evaluators complete all aspects of the evaluation if possible.
The Undergraduate Research Project served 18 Oxnard College students by providing them with hands-on research experience in the Biology 122L class. Students had an opportunity to work in groups to collect, analyze, and interpret data and summarize their findings in a research report. Students also interacted with scientists in the field and performed dissections in the lab.

Analysis of the data collected suggests that the students and instructor tended to be satisfied with their overall experience in the class. Many reported positive experiences and future anticipated behaviors (i.e., students transferring to a four-year college or university, instructor planning on implementing changes for the future), as measured by certain interview item statements. The open-ended responses also tended to be favorable, although some students and the instructor believed that certain improvements could be made in the future. All together, it is reasonable to conclude that the Undergraduate Research Project was a worthwhile experience for students as it provided students with opportunities to work collaboratively in groups, meet scientists in the field, and increase their research and networking skills.

Participation in such research-based labs may contribute to more intermediate outcomes, such as increasing student interest in STEM and increasing students interpersonal, intrapersonal, and academic skills. In addition, being involved in this Biology 122L lab may be a factor in the achievement of more distal outcomes, such as increasing STEM career awareness and motivation, increasing students’ confidence, increasing networking skills, increasing students’ probability of transferring to a four-year university, and increasing students’ academic success.

To improve the implementation of this Undergraduate Research Project in the future, some recommendations are provided. Also, there are suggestions to improve the data collection that will better assist in the evaluation. It should be noted that this is the first year the Undergraduate Research Project is being evaluated. Thus, this is a formative evaluation such that recommendations are provided to improve the Undergraduate Research Project for the next school year.
Student Recommendations

- Students would like to have seen better organization throughout the semester. Students mentioned that they like knowing what is expected ahead of time. For example, one student mentioned that the syllabus was altered verbally and the syllabus was never revised, thus making expectations unclear. Some students also mentioned being more prepared before going onto site. For instance, students suggested organizing logistics on how to get on base and how to conduct field work might have been helpful. Another student suggested forming groups to discuss data collection procedures prior to entering the field.
  
  o One solution would be to include the expectations and explanation of what the field work entails on a handout or to include it on the syllabus. That way, students have a clearer idea of what to expect prior to conducting research in the field.

- Students articulated they wanted to spend more time on group projects without losing the hands-on experience.
  
  o Perhaps it would be helpful to set time limits and assign roles for various tasks. For example, if there were 35 minutes for students to collect data, there could be 10 minutes allotted to set transect lines, 15 minutes for one to two students to count the native plants within the lines, and 10 minutes for the remaining group members to record data. Having these time limits may help manage the total time spent on the group project and provide more time for students to get a more hands-on experience.

- Students unanimously agreed that there should be more field days and more observations over the course of the semester.
  
  o This will be at Dr. Buckley’s discretion and will depend on the schedule of the class. Dr. Buckley mentioned in her interview that timing was an issue since there did not seem to be enough of her time to dedicate to the project.

- Students suggested having more scientists in the field and having more consistency throughout the project.
Some students mentioned in their interviews that they did not get a chance to work with all of the scientists. It would be beneficial for students if there were additional scientists in the field who can help with the project.

- Some students were not comfortable with the dissections on animals, particularly the smell of the preserved animals.
  - Perhaps it may be helpful for students to wear surgical masks or take breaks during the dissections to get some fresh air.
- One student suggested that more classes should include research projects.
  - This would be a great topic of discussion at the next STEM Stew. It would be interesting to see if other STEM faculty incorporate research projects into their curriculum, and if not, how to go about in including research projects.

**Instructor recommendations**

- Dr. Buckley recommended combining the 122 lecture class with the 122 lab class, but separating the 122L and 199 classes. She suggested having the 122L class meet six hours a week during the regular semester and have the 199 class during the summer as a follow up to the 122L class.
- Dr. Buckley also suggested reducing the class size from 19 to about 15 to 16 students.
- Dr. Buckley recommended reserving some time for students to present their figures before the final so students would have a better understanding of the analysis before writing up the final report.
- She suggested that before going into the field, have partners give 15-minute mini-presentations of who they are, what they do, what their research interests are, provide their contact information, and pose questions to the class. This would help students warm up to one another and be prepared to work in groups.
- She also suggested working with professors in the earlier biology course sequences to plan activities that would prepare students for the Biology 122L class. For example, she recommended students conduct literature reviews in the 120 class, where students can write up details about the project before getting to her class.
Evaluator Recommendations

- In addition to the students’ and instructor’s recommendations, I recommend making some changes to the self-assessment form. First, include a date on the self-assessment form in case a student fills out the form twice, I would analyze the most current form.

- I recommend adding an “NA” column where students, who have previously learned this skill in another class, can select NA and not be forced to select the lower rankings.

- The ranking on the self-assessment form should be listed one through five so students can select which response best suits them instead of writing in the rankings themselves. For example, the old self-assessment form looks like the following:

Use the following scale:
5=agree strongly  4=agree  3=no opinion  2=disagree  1=disagree strongly

**INTRAPERSONAL SKILLS**

**Critical Thinking and Problem Solving**
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

- Think analytically
- Generate good ideas
- Form opinions based on logic and facts
- Understand different points of view
- Apply knowledge to solve problems
- Be very attentive
- Formulate questions well

It could be revised to actually list the rankings and look like the following:
INTRAPERSONAL SKILLS

Critical Thinking and Problem Solving
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:” Please CIRCLE the response that best fits your opinion.

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<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>NA</th>
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<td>Think analytically</td>
<td>1</td>
<td>2</td>
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<td>Generate good ideas</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
</tr>
<tr>
<td>Form opinions based on logic and facts</td>
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<td>NA</td>
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<tr>
<td>Understand different points of view</td>
<td>1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
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<tr>
<td>Apply knowledge to solve problems</td>
<td>1</td>
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<td>5</td>
<td>NA</td>
</tr>
<tr>
<td>Be very attentive</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
</tr>
<tr>
<td>Formulate questions well</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
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- Rephrase the question stem to be clearer about what the students are assessing their skills in. In a planning meeting with Dr. Buckley, she wanted to assess these skills specific to the three phases. Perhaps the self-assessment form should be revised to address this alignment of skills to phases. For example, instead of the question stem, “Reflect based on your experiences from the BIO R122L: Project-based learning (wetland/island projects) improved my ability to:,” it should be revised to say the following:
  - “My in-lab research improved my ability to …” or
  - “My on-site research improved my ability to …” or
  - “My in-lab analysis improved my ability to …”

These specific question stem will help the evaluator locate which skill sets are specific to each phase.

- To help with the data collection and answer any questions students may have, it is recommended that evaluators administer and collect the self-assessment forms.

- I also recommend the evaluator to get in contact with the professor before the start of the semester to plan logic models and discuss evaluation tools. This early planning proved to be helpful in the evaluation process.
Considering the successful implementation and most favorable outcomes of the Undergraduate Research Project, it is recommended that this project run again in the future. The effective format of the program—integrating project-based learning, conducting field work, and meetings scientists in the field—may serve to increase students’ career awareness, stimulate students’ interest in STEM, increase students’ confidence, and students’ academic success.
Appendix A: Logic Model for Undergraduate Research Project – Biology 122L Research-Based Learning

**Resources**
(Human, financial, organizational, and community resources to direct the work)

- Oxnard College professor (Dr. Lori Buckley)
- CSU Channel Islands partners (Steven Norris, Morly, Angela Chapman)
- Restoration partners
- Restoration projects
- HSI-STEM grant money

**Activities**
(Intentional processes, tools, events, technology, & actions, used to bring change/intended results)

- **Phase 1**
  - In-lab research and learning

- **Phase 2**
  - On-site research in groups, including:
    - Taking measurements
    - Meeting with professionals

- **Phase 3**
  - In-lab analyses, write ups and presentations

**Outputs**
(Direct products of program activities, may include type, levels, and targets of services to be delivered by the program)

- Students learn about different types of career pathways, research & research components
- Students are engaged in a research project as a group and have opportunities to interact with colleagues, mentors, professors, and scientists
- Students produce their own products as scientists, including groups’ write ups and presentations

**Outcomes**
(Specific changes in program participants’ behaviors, knowledge, skills, status and level of functioning)

- **Immediate**
  - Personal skills: resourcefulness, ability to manage frustrations, analytical thinking, ability to organize one’s work
  - Interpersonal skills: ability to interact with colleagues and professionals
  - Advanced academic skills: data management, equipment use, presenting one’s work using various media

- **Long-term**
  - Increased STEM career awareness and motivation
  - Confidence (knowing how to present one’s self)
  - Study partners (knowing how to network/expansion of peer group)
  - Increased probability of transfer to a four-year university
  - Academic success (as measured by GPA, retention in the STEM major, transfer success, acquisition of STEM degree)
Appendix B: Student Self-Assessment Form

OC ID # ______________________  Name ________________________________

This form will assess your characteristics/skills as affected by the project-based learning in BIOL R122L. Assess the following statement:

Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

Use the following scale:
5=agree strongly  4=agree  3=no opinion  2=disagree  1=disagree strongly

**INTRAPERSONAL SKILLS**

**Critical Thinking and Problem Solving**
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to:”

____ Think analytically
____ Generate good ideas
____ Form opinions based on logic and facts
____ Understand different points of view
____ Apply knowledge to solve problems
____ Be very attentive
____ Formulate questions well

**Motivation and Work Ethic**
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

____ Work hard
____ Set and achieve positive goals
____ Show initiative
____ Have good time management skills
____ Work independently
____ Organize one’s work well
____ Be very resourceful
____ Network/expand peer groups
Ethics and Integrity
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

____ Show respect for classmates
____ Show respect for teachers
____ Be worthy of trust from others
____ Be engaged in school activities
____ Be engaged in community citizenship activities
____ Treat all people fairly
____ Demonstrate responsibility

Persistence and Resilience
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

____ Remain calm under pressure
____ Manage frustrations well
____ Overcome challenges and setbacks
____ Persistent

Self Concept
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

____ Not be anxious in the classroom/laboratory
____ Feel confident in myself
____ Value my personal contribution to team
____ Have a better understanding of Science, Technology, Engineering, and Mathematics (STEM) careers

INTERPERSONAL SKILLS

Leadership and Teamwork
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

____ Handle different social situations
____ Work well in group settings
____ Appreciate the perspectives of others
____ Give helpful criticism/feedback to others
____ Interact well with colleagues/professionals
____ Be culturally sensitive
____ Embrace diversity
Communication Skills
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

_____ Write essays well
_____ Express ideas clearly in short written text (emails, notes, memos)
_____ Express ideas clearly in oral presentations
_____ Get point across effectively in conversations and discussions

ACADEMIC SKILLS
Reflect based on your experiences from the BIO R122L: “Project-based learning (wetland/island projects) improved my ability to: ”

_____ Read scientific literature
_____ Conduct literature reviews – (e.g., finding scientific papers)
_____ Build a scientific bibliography
_____ Conduct the scientific method
_____ Write in a scientific format (e.g., introduction, methods, results, discussion)
_____ Write in a scientific style (e.g., past tense, no modifiers, few words)
_____ Collect data
_____ Manage data (e.g., cataloging data, data cleaning)
_____ Analyze data
_____ Interpret data
_____ Produce data graphics/figures
_____ Present one’s work using various media
_____ Communicate with scientists
_____ Be more aware about career paths/opportunities
_____ Design experiments
_____ Use sampling techniques
_____ Use different environmental assessment methods
_____ Use different types of equipment
_____ Know more about natural communities
_____ Know more about ecological concepts
_____ Know more about plant identification
_____ Know more about animal identification
_____ Understand funding sources for research
_____ Understand collaborative nature of research
_____ Understand community-based projects
_____ Understand community partnerships
Additional Questions

3. Based on your experiences in this class, what skills do you believe has improved the most?

   a. In what ways have these skills improved?

4. Based on your experiences in this class, what skills do you believe has not improved?

   a. In what ways have these skills not improved?

Please feel free to add any additional comments:

Thank you!!
Appendix C: Student Interview Questions

Bio 122L: Research-Based Learning
Student Interview Questions
May 6th, 2013 at _____:____ AM / PM

1. What is your name?

2. What is your major?

3. Do you plan to transfer to a 4-year college or university?

4. Please describe your experience in this class.
   a. What did you like most about this class?
   b. How do you think BIOL R122L can be improved when this course is taught in the future?

5. What are the different types of
   a. Career pathways that you have learned in this class (e.g., guest speaker, meeting with professionals)
   b. Research skills that you have learned in this class (e.g., field work, in-lab research, literature review)?

6. How did working in a group for your project enable you to engage in the following aspects of research:
   a. Collect data?
   b. Analyze data?
   c. Write ups?
   d. Presentations?
7. Did you have opportunities to interact with
   a. Colleagues (i.e., other students in the class)?
      i. If yes, please describe. (If no, skip to the next question)
   b. Mentors (i.e., other students who previously took this class, tutors)?
      i. If yes, please describe. (If no, skip to the next question)
   c. Professors?
      i. If yes, please describe. (If no, skip to the next question)
   d. Scientists (i.e., guest speakers, professionals in the field)?
      i. If yes, please describe. (If no, skip to the next question)

8. To what extent do you feel this class has increased your
   a. STEM career awareness
   b. Motivation to pursue a STEM career
   c. Confidence (i.e., knowing how to present one’s self, collecting data, analyzing
data, reporting data, etc)
   d. Networking (i.e., study partners, knowing how to network/ expansion of peer
group)
   e. Probability/ Likelihood of transfer to a four-year university

9. What do you think your grade will be at the end of this class?

10. Do you have any additional comments you would like to add that we have not discussed
    previously?
Appendix D: Instructor Interview Questions

Bio 122L: Research-Based Learning
Instructor Interview Questions
Date: _________, Time: _________

1. Please describe your experience teaching this BIOL R122L class during the Spring 2013 semester.
   a. What did you like most about teaching this BIOL R122L class during the Spring 2013 semester?
   b. In what ways did you find teaching BIOL R122L this year (Spring 2013) different from last year (Spring 2012)? Please describe.

2. What are the different types of
   a. Career pathways that you believe students learned in this class (e.g., guest speaker, meeting with professionals)
   b. Research skills that you believe students learned in this class (e.g., field work, in-lab research, literature review)?

3. How do you think working in a group for the class project enabled students to engage in the following aspects of research:
   a. Collect data?
   b. Analyze data?
   c. Write ups?
   d. Presentations?

4. Did the students have opportunities to interact with
   a. Colleagues (i.e., other students in the class)?
      i. If yes, please describe. (If no, skip to the next question)
   b. Mentors (i.e., other students who previously took this class, tutors)?
      i. If yes, please describe. (If no, skip to the next question)
   c. Professors?
      i. If yes, please describe. (If no, skip to the next question)
d. Scientists (i.e., guest speakers, professionals in the field)?
   i. If yes, please describe. (If no, skip to the next question)

5. To what extent do you feel this class has increased students’
   a. STEM career awareness
   b. Motivation to pursue a STEM career
   c. Confidence (i.e., knowing how to present one’s self, collecting data, analyzing data, reporting data, etc)
   d. Networking (i.e., study partners, knowing how to network/ expansion of peer group)
   e. Probability/ Likelihood of transfer to a four-year university

5. How do you think BIOL R122L can be improved when this course is taught in the future?

6. What were some of the challenges you faced in teaching this course during the Spring 2013 semester, if any?
   a. How do you plan address these challenges when this course is taught in the future?

7. Do you have any additional comments you would like to add that we have not discussed previously?