STUDENTS ‘TACKLE’ BIOLOGY PROBLEM SOLVING SKILLS WITH REAL-WORLD FOOTBALL ACTIVITY

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ABSTRACT

Introductory biology students struggle with analyzing quantitative problems. A biologist's ability to quantitatively analyze is a major skill in any biology course, identified by Vision and Change (2011). Our non-science major nutrition students struggle with quantitative energy conversion problems, largely due to low college math and applied sciences experience. It was hypothesized that providing students with a connectable research activity and allowing more time to work in groups on these problems would help them with their quantitative analysis skills.

Students were provided with a national sports media report that described a professional football star requiring 9,000 calories daily, and further stated that this was the equivalent of 50 slices of bacon, 20 chicken breasts, and 13 whole avocados. Students were asked to determine if the reporter was correct in their calculation of the total calories coming from the reported foods, based upon their research and calculations. Students discovered that their different sources of caloric information provided very different (albeit accurate) calculated total calories, ranging from 6,000-10,000 calories. Students generated a professional letter outlining their calculated differences that was sent to the media reporter. The students were assessed on their calculations based upon their researched evidence, their professional letter to the reporter, and finally their summative scores on quantitative questions.

Surveyed students indicated that the real-world problem helped prepare them for the problems on the exam. This was confirmed by student's achieving significantly higher (average = 73%) on their summative energy problems than last year's cohort (average = 40%) (Student's t-test, p = 0.03). Further, students were motivated by the activity, as assessed by their quality of research, accuracy of calculations, and professional letters to the reporter.

In conclusion, providing student opportunities to explore problem solving with in-class group research and authentic problems allows students to take ownership of their learning and helps them succeed in solving quantitative problems.

RATIONALE

Learning Objective: Analyze quantitative caloric intakes based upon food consumption.

Class Average of 40% on quantitative analysis summative assessments

Student Athlete Population in Course: ~ 50 %

ACTIVITY

9,000 Calories per Day

Students watch video and read article on the football player and his diet.

1. Present the National Sports Report Video

2. Organize Research Groups

3. Organize and Report Class Data from Groups

4. Organize Group Letters to National Sports Reporter

Students research websites for nutrition data and calculate caloric impact.

Students create letters explaining the discrepancies in the data and seek clarification of report.

RESULTS

Summative Assessment Results

Only Quantitative Problems

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Student Grade (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>72.4</td>
</tr>
<tr>
<td>Activity</td>
<td>81.1</td>
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</tbody>
</table>

Overall Exam Total

<table>
<thead>
<tr>
<th>Activity</th>
<th>Average Student Grade (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>82.9</td>
</tr>
<tr>
<td>Activity</td>
<td>90.2</td>
</tr>
</tbody>
</table>

Students with this presented activity in their course performed significantly higher (**, p-value = 0.03) as a class on summative quantitative problems on exams compared to students lacking the activity. Importantly, both classes performed equally as well (n.d., no statistical difference, p-value = 0.72) on the exam.

CONCLUSION

Activities that promote student research with real-world data sets excites students to explore and work on their quantitative reasoning skills.

RESOURCES

Contact: Jacob Adler
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9,000 Calories

Group 1: 6,452 Calories
Group 2: 7,134 Calories
Group 3: 7,688 Calories
Group 4: 7,859 Calories
Group 5: 10,066 Calories

...we found out that our values differed based upon specifics, like what type of bacon was used, how the chicken was prepared, and where the avocados were harvested.