The Value of a Summing-Up Quiz in Introductory Biology Workshop on Exam Anxiety and Performance

Introduction

The workshop model uses a group problem-solving approach to teaching. While this has been found to dramatically improve student performance, students may still struggle with high levels of anxiety before exams. In workshops, students may rely on one another, outside resources like lecture notes and the internet, and on the workshop leader. Exams, on the other hand, allow none of these resources. Although workshops provide an excellent means for learning, some students may have difficulty in transferring their acquired knowledge to a written exam setting.

Study Purpose

In this study we investigated whether weekly, ungraded re-cap quizzes given at the end of workshop and returned with written feedback the next week could serve a purpose in either improving students’ test scores or reducing anxiety.

Our study differs from previous work in that the quizzes are ungraded. This removes the incentive for students to study material before the quiz – possibly a confounding factor in previous studies. If the quizzes were graded, students might be incentivized to study rather than leave the material until right before the exam. This is not the purpose of our study; rather, we want to investigate the role of answering questions and receiving feedback in aiding learning. The quizzes differ from the workshop questions in that the answers must be written, and completed by an individual student (rather than the group) without the help of a workshop leader. Therefore, quizzes provide a way for students to practice expressing their knowledge in a way similar to the exam.

Method

Twenty-eight introductory biology students were divided into four study group. The number of students in each group is shown below.

<table>
<thead>
<tr>
<th>Quiz</th>
<th>Workshop Leader</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Katie</td>
</tr>
<tr>
<td>Yes</td>
<td>6</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
</tr>
</tbody>
</table>
This design allowed for control against different teaching styles.

The study period was 3 weeks long, between the second and third exams of the semester. Workshops met once per week during the study period.

In the quiz groups, a short quiz was given to the students at the end of each workshop. The students were told at the beginning of the workshop that there would be a quiz, and that the questions will be about material covered in that day's workshop. During the first two weeks of the study, the workshop leader collected and corrected the quizzes, returning them at the following week's workshop. In the third and final week before the exam, the correct answers were reviewed immediately after taking the quiz, and the students were instructed to correct their own papers.

In the no quiz groups, workshops were conducted in the same way as in the quiz groups except that there were no quizzes.

At the end of the study period (after the exam), the workshop leader had the students fill out the following survey:

<table>
<thead>
<tr>
<th>Post-Study Survey Questions – For All Groups</th>
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</thead>
<tbody>
<tr>
<td>1. On a scale of 1 – 5, how well do you feel the previous 3 workshops prepared you for Exam 3?</td>
</tr>
<tr>
<td>2. On a scale of 1 – 5, how much did you feel like you knew what to expect on Exam 3?</td>
</tr>
<tr>
<td>3. On a scale of 1 – 5, how anxious or nervous were you before Exam 3?</td>
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<tr>
<td>4. Compared to the way you felt on Exams 1 and 2, did you feel a higher, lower, or similar level of anxiety or nervousness about Exam 3?</td>
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<tr>
<td>5. How do you think you learn best?</td>
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<table>
<thead>
<tr>
<th>For Quiz Groups Only:</th>
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<tbody>
<tr>
<td>6. Do you feel like having weekly workshop quizzes impacted your learning of the material presented in those workshops?</td>
</tr>
<tr>
<td>7. Did having weekly workshop quizzes impact your level of anxiety about Exam 3?</td>
</tr>
</tbody>
</table>

After the exam was graded, the average grade in each of the study groups was calculated and compared. This average was normalized by comparing it to the average grade of each study group on Exam 2. We also calculate the average change in grades between Exam 2 and Exam 3 for students in each study group and compared these.

**Results**

One student in the quiz group was omitted from the study after missing two of the three quizzes as well as the survey.

**Exam Scores**
The average score on Exam 3 for students in the quiz group was 69.9. The average score on Exam 3 for students in the no quiz group was 58.02.

Taking into consideration possible differences in student performance in the two groups, these results were normalized by comparing them to the students’ scores on Exam 2. It was found that students in the quiz group, on average, scored 6.625 points worse on Exam 3 than they did on Exam 2. Students who did not take quizzes, on average, scored 9.41 points worse on Exam 3 than they did on Exam 2.

To normalize for difference in exam difficulty and over-all class performance, students’ standard deviation from the class mean for both Exam 2 and Exam 3 were calculated. The results are shown in the chart below.

**Survey Results**

The exact text of the questions is presented above. For statistical analysis of question 4, a response of “higher” was given a numerical value of 5, “similar level” was given 3, and “lower” was given a 1.
Selected answers to questions 6 and 7 are recorded in the tables below. These answers were selected to be representative of over-all student responses. Repetitive, nonsensical, and blank responses were omitted. Students had mixed positive and negative responses to question 6. Responses to question 7 were overwhelmingly negative.

<table>
<thead>
<tr>
<th>Question 1</th>
<th>Question 2</th>
<th>Question 3</th>
<th>Question 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz</td>
<td>No Quiz</td>
<td>Quiz</td>
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</tr>
</tbody>
</table>

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### What Students Had to Say: Selected Answers to Question 6, “Do you feel like having weekly workshop quizzes impacted your learning of the material presented in those workshops?”

- Weekly quizzes were annoying at the end of workshop, but they highlighted the main points of the workshop.
- No. I think that having a quiz on the material from that workshop is pointless, but having a quiz from the prior week will help one remember.
- It was a good way to review material learned in the workshop.
- It tested how much knowledge I had in the certain topic we were learning about, so it did help in some way.
- It helped to see if you understood the material learned in workshop.
- Yes, because it’s actually doing the work and what we are learning.
- Yes. They pointed out the most important things to know.
- Yes, they show how much material I retained from the workshop.
- Yes. It reinforced some other information I had learned.
- Helped (a lot)

### What Students Had to Say: Selected Answers to Question 7, “Did having weekly workshop quizzes impact your level of anxiety about Exam 3?”

- No not really. I felt that having quizzes made me want to study more after.
- Make me feel a little more comfortable with material.
- The quizzes didn't lessen my anxiety, but it did help to point out the key points of workshop/exam 3.
- No
- Not really
Discussion

According to the data, the quiz group did perform slightly better than the no quiz group on the exam. This is consistent with previous work done on the value of quizzes, and suggests that quizzes may be a way to help improve student performance. Due to the small study size and the relatively small difference in exam performance between the two groups, we are unable to reach any conclusive decision about whether or not quizzes have much value in the workshop setting. The slight improvement in exam scores combined with the many positive student responses to question 6 suggest that there may be some value in quizzes for increasing student performance. Based on our promising results, we hope that more research can be done in this area in order to reach a more definitive conclusion.

Some interesting details were observed from the surveys. On question 1 regarding how prepared the students felt after the workshops, the quiz group felt that they were more prepared on average than the control group. Question 2 discusses if students felt they knew what would be on exam 3, and in this case the control group felt more informed. Question 3 results show that the control group was more anxious for exam 3 than the quiz group, and question 4 showed that the quiz group was the most anxious for exam three compared to previous exams.

An unexpected result of this study was the benefit of a weekly quiz to the workshop leader. Receiving immediate feedback on what students had understood provided a way for the workshop leader to know whether or not their explanations or leadership style was being effective. Also, the quizzes pointed out those students who were struggling with the material, which can be useful information for the workshop leader. Comparing quiz results with level of participation in workshop was particularly interesting and varied widely. There were both students who were very vocal during workshop but still performed poorly on the quiz, as well as quieter and less engaged students who scored highly. Particularly concerning, of course, were the students who scored low on the quiz and seemed disconnected from workshop. Just as students need feedback on how well they have learned, workshop leaders too need feedback on how well they have facilitated learning; both aims can be accomplished with the quiz.