THE EFFECT OF DAILY QUIZZES ON STUDENT PERFORMANCE IN SCIENCE EXAMS

by

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ABSTRACT

In this investigation, daily quizzes were used as a means of improving student performance on science exams. A variety of daily quizzes were utilized throughout the research including multiple choice, free response, matching, true/false and fill in the blanks with the purpose of measuring student learning and retention while providing the teacher with an immediate feedback on student learning. Performance in tests showed a significant improvement when daily quizzes were used, which demonstrated that daily quizzes do have a positive effect on student performance in science exams.

INTRODUCTION AND BACKGROUND

In the last three years, the State of Texas introduced end of course (EOC) exams in various subjects as a requirement for high school graduation. This prompted many school administrators to find ways that they thought would help students to learn the concepts taught and be ready for these EOC exams. Many students in my school did not do well in benchmark tests and end of course exams, prompting the administration to direct that teachers conduct daily quizzes as a measure to help students pass their exams. However, no rationale was given for using the daily quizzes, and no guidelines were given for their use. As a result, many teachers resisted this directive because they saw it as a waste of their valuable instructional time. They also thought it was unrealistic to conduct a meaningful quiz every day. On the basis of these concerns and to try to justify the rationale for daily quizzes, I decided to carry out an action research (AR) project on the impact of daily quizzes on student performance in end of course exams.

The results of this action research would not only be significant to me, but to my fellow teachers, administrators, parents and more importantly, the students. Several of my colleagues have been following closely to see what I am uncovering in my AR. The administration is an interested party, and the parents and students would be glad to see improved performance in these important exams. As a teacher, the result of this AR would have a great impact on my professional development and on what strategies I would use to ensure that my students are not only successful in EOC exams, but are also ready for the next stage in their education.

Focus Question

In my AR, I intended to answer several questions. The main focus question was: What is the impact of daily quizzes on student performance in end of course exams? In addition to the focus question, I had several sub-questions which I wanted to address in my action research. These included the following:

1. Do students' attitudes and motivation change as a result of daily quizzes?
2. How can I effectively use daily quizzes to improve instruction?
3. Does daily quizzing help improve student retention of learned concepts?

In order to answer these questions, I included a three member support team composed of the following: Mr. Thomas Liu, Principal, who was very supportive to me through the process, signing off my exemptions and just being there to answer my questions. Mr. Alex Neus, History and English teacher at my school, who gave me useful ideas and critiqued my work, and Ms. Marcie Reuer, Doctoral student at MSU, who was very helpful in providing constructive feedback to help polish my work.

CONCEPTUAL FRAMEWORK

Several studies have been undertaken on the impact of frequent testing (and daily quizzes) on student performance. In a study of 70 high school students, Gholemi, V (2013) found that the final achievement score was significantly higher for students who were in the weekly quiz treatment group than that of students who were in the control group which was not quizzed. In another study of 79 students, Poljicanin, A, Caric, A, Vilvovic, K, Kosta, V, Guic, M. M, Aljinovic, J, & Grkovic, I, (2009), evaluated the effects of daily written 10-question quizzes on the success of medical anatomy course

students. The results of the study showed that there was a positive correlation between scores on quizzes and grades on written, practical and oral components of the final examination compared to the previous year, in which daily testing was not a part of the course.

For example, the researchers reported that, "Compared with students in the previous academic year, students attending the course with daily quizzes significantly improved their academic achievement, expressed as the pass rate at the first examination term (39% vs 62%, respectively, χ^2 test, $p = 0.006$) and the average course grade (2.71 ± 1.08 vs 3.38 ± 1.26, respectively; t test, $p < 0.001$)" (Poljicanin, A, et al, 2009, p. 55). Though the quizzes were given at the end of class, the study nevertheless proved that frequent testing does have a positive impact on student achievement.

Apart from improved performance in the anatomy course, the researchers also found that the introduction of daily quizzes conveyed to their students that testing is a "fact of life" (Poljicanin, A, et al, 2009, p. 59). In addition, the students found that their study habits improved and were better able to identify the key-learning issues in addition to receiving frequent feedback on their performance. This finding was a key area in my action research study, as one of my sub-questions focused on how daily quizzes affect students' attitudes and motivation to study, and also whether daily quizzes help to improve student retention of learned concepts.

Research has also shown that mastery testing, when used as a diagnostic tool and followed with remedial help, improves classroom learning (Kulik & Kulik, 1986-87). This finding is significant for me because it relates to another of my sub-questions on

how I can use daily quizzes to improve instruction. Kulik & Kulik's research showed that daily quizzes can play an important role in improving classroom learning. Over the course of my AR, I have utilized several opportunities where I have caught misconceptions quickly through the use of daily quizzes and the various data collection instruments to address them and where necessary offer remedial classes before it is too late.

In their study, Bangert-Drowns, R. L, Kulik, J. A & Kulik, C. C, (1991), found that, gains in test scores were incrementally smaller with each test added to the course. They also found that a larger number of shorter tests resulted in better performance than fewer tests which were longer. They concluded that teachers should engage in testing more often to improve the performance of the students. The results of this study agree with one of my survey questions where students were asked "I prefer taking daily short quizzes covering less information while it is fresh in my mind." In response, 81% of the students indicated "agree" or "strongly agree" in the mid-treatment survey, up from 67% in the pre-treatment survey.

Another important finding of this research is the impact of frequent testing on student attitude. According to the article by Bangert-Drowns, R. L, et al, four studies measured students' attitude toward instruction following programs of varying test frequency. The frequent testing condition had the effect of making students' attitudes more positive by 0.59 standard deviations. That is, students in those studies had more favorable opinion of their instruction when they were tested frequently. Increasing the frequency of tests may be a way of creating a more positive atmosphere in the classroom

(Bangert-Drowns, R. L, 1991, p. 98). One of the other important advantages of frequent testing is that it creates extrinsic motivation for the students. Since students want to obtain good grades in the course, they try hard and spend a lot of time preparing for the quizzes (Dustin, 1971). The effect is that students prepare more for the quizzes since the test itself is a good source of motivation.

Thirey, B (2011), found that there is a slightly positive relationship perceived between daily quizzing and exam performance. The study also revealed that the majority of students do not want any sort of competition interjected into the exercise because they felt emotionally removed or not confident competing with others. The study also found that quizzing over the previous day's material is the most preferred option for enhancing retention, something that I captured in the course of my treatment.

According to Thirey (2011), 63% of students preferred quizzes over previously covered material, 22% preferred quizzes over fundamental concepts and only 18% preferred quizzes over the current day's lesson. Overall, the researcher found that administering daily quizzes was a worthwhile exercise, though the students believed that the exercise was only slightly beneficial in performance on tests (Thirey, 2011, p. 8). In my AR, a small percentage of students did not think that that daily quizzes were helpful, but the majority of them agreed that they helped them pass their tests. The difference with Thirey's findings could be a result of differences in approach, frequency and method of quizzing.

In her study on the effect of frequent quizzing on student learning in a high school physical science classroom, Norton, B.C. (2009), states that her quizzes were designed to

be short, multiple-choice questions that focus on the material covered in the previous days lecture. This is the same format that I have used although my question type and format was more mixed. Like Norton, however, all quizzes were graded promptly, and then I reviewed them while addressing specific areas of interest and/or concern to the students.

According to the findings of Norton's study, overall, statistical analysis showed that there was no difference between the post-test scores of those students that were quizzed and the students that were not quizzed. However, she goes on to say that while there was no statistically significant gain, there was an overall gain from the pretest to post-test scores of the experimental group. Furthermore, during one-on-one interviews that were conducted, the overall consensus was that the quizzes were a great tool in helping students distinguish what they knew and what they did not know (Norton, B.C., 2009).

When it came time for the students to be part of the control group (a non-quizzed chapter), they often asked if they could get quizzed because it would help them prepare for the test (Norton, B.C., 2009, p. 26). These observations agreed with those of my students who thought that daily quizzes helped them to prepare and pass their tests. Finally, Norton reported that she found that when it came time to take the chapter test, the students who had been quizzed on the information were more confident in their ability to pass the test than those students who had not been quizzed (Norton, 2009, pp.28-29).

An article by Kocian, (2013), compared pre-intervention unit quizzes, unit tests, and quarter grades scores from one year (first and second quarter) to unit quizzes, unit

tests, and quarter grades scores from the previous year on the same material and she compared post-intervention unit quizzes, unit tests, and quarter grades scores from one year (third quarter) to unit quizzes, unit tests, and quarter grades scores from the previous year over the same material (Kocian, 2013, p. 11). Her method of comparison is very similar to what I used to check the effectiveness of my treatment.

Liebmann, R and Sindberg, M, (2010), set out to determine if there would be a significant effect on high school Physics and AP Physics student performance when formative assessment probes were added to the classroom learning process. Evidence of the students' understanding was gathered by examining their performance on bi-weekly summative tests. Post-surveys were given to the students for their feedback on the action research process. A small selection of students were interviewed for their reactions and viewpoints on the different instructional methods. This study also focused on the effect of frequent assessment on student performance.

According to Liebmann and Sindberg, during the interviews, there was an overwhelming response from the students that the formative assessment probes were of great benefit to them. Only a couple of the AP Physics students (less than 20%) expressed indifference about the process. Several Physics students felt that the formative assessment probes kept the material "fresh in their minds," and students also stated that they felt that they were "better able to retain" the information (Liebmann, R, 2010, p. 24), which is an important observation that my students mentioned during my interviews and survey responses. The researchers also used interviews as a means of providing a good

opportunity for the students to voice their opinions and give suggestions for improvement.

METHODOLOGY

I teach freshman biology and my action research project ran from September to early December. However, I continued with data collection through the end of February. Since my main focus question is the effect of daily quizzes on student performance in science exams, and especially end of course exams, my main data collection instruments were the daily quizzes that I administered. Although I carried out this AR with the main focus on the biology EOC exam, my hope is that the results of my study can be replicated to other subjects where EOC exams are required.

Since my main treatment consisted of daily quizzes, I administered a quiz every day at the beginning of class. At other times, especially when I was beginning a new topic, the quizzes were given after the lesson, normally in the last ten minutes of class. The quizzes were between five and ten minutes long, and would normally contain between five and ten questions. At the beginning of my treatment, the quizzes would test what was covered the previous day, but as the semester progressed, the quizzes covered more and more content taught over a longer duration, in some cases as far back as the beginning of the semester. The quizzes were normally a mix of multiple choice, free response, matching, fill in the blanks or true/false questions.

The questions also included a good mix in terms of difficulty or Bloom's taxonomy, especially as we progressed in the treatment and I started using Texas State released test questions to include in the quizzes. The quizzes were graded using a variety

of methods, which included students switching papers, one class grading another, teacher graded, and students grading their own work. As much as possible, feedback was provided immediately, even if the test was not graded immediately. This way, the students had an opportunity to notice their mistakes and correct them, and it also provided me with an early opportunity to address student concerns, misconceptions and/or misunderstandings. The quiz scores were then tabulated on a spreadsheet and an average score computed at the end of the week. These grades were also entered into the gradebook as the students' weekly average quiz score.

At the end of every two to four weeks, an extended 30-40 minutes long test was given, which generally covered all the content learned in the previous weeks and included a mix of questions from the daily quizzes of those weeks. An in-depth analysis of the test was conducted using a Scantron Analysis Sheet to determine in which State Standards or learning objectives students were having more trouble. This data would then be used to re-teach, modify instruction or conduct further study.

My sample consisted of 63 students, out of whom, 30 were female and 33 were male. There were 55 Hispanic students accounting for 87% of the sample size and eight African-American students, making the remaining 13%. My school is a Title I school and over 93% of the students are economically disadvantaged and are, therefore, on free or reduced lunch. The school population is 90% Hispanic, 9.3% African-American and 0.7% White. Most of the students come from single parent families and a number of them have after school jobs, mainly working with their parents to help them in their jobs. Most students walk to school from the neighborhood, coming from generally low income

families. Over 85% of the students speak Spanish as their first language and so English is their second language. Over 81% of the students are ELL's and 56% of them are bilingual.

Data Collection

As mentioned earlier, the main method of data collection was the daily quizzes. End of topic tests and benchmark tests also provided important quantitative data that was used to answer my main focus question as well as other sub-questions. Samples of the daily quizzes and tests used are provided in the Appendix A and Appendix B. Other data collection methods used included Classroom Assessment Techniques (CAT's) like Minute Paper, One Sentence Summary, Exit Tickets, and Exam Evaluations; Likert surveys, Teacher Journals and individual/focus group interviews as shown in the triangulation matrix below:

Table 1.
Triangulation Matrix

	Data Collection Methodologies				
Research Question	Pre/Post-tests, quizzes, benchmarks/ tests/bi-weekly/monthly tests	CATs: Exam Evaluations, Classroom Opinion Polls, Minute Paper	Student Surveys Likert scales	Individual Student/Focus Group Interviews	Teacher Daily Journal
What is the effect of daily quizzes on student performance	X	X	X	X	X
Do students' attitude and motivation change as a result of daily quizzes?		X	X	X	X
How can I effectively use daily quizzes to improve instruction?		X	X	X	X
Does daily quizzing help improve student retention of learned concepts?	X	X	X	X	X

Likert type surveys were used to collect qualitative and quantitative data that was used to answer my AR questions. The first pre-treatment survey was conducted on September 26, 2014, two weeks after beginning treatment, and the mid-treatment survey was conducted four weeks later on October 24, 2014. Both treatments were administered after either a chapter or benchmark test. The pre-treatment and mid-treatment surveys are shown in Appendix C and Appendix D. I administered the post-treatment survey in early

December after the end of semester exams (see Appendix E). There were eight questions in the pre-treatment and mid-treatment surveys, and students were required to choose one choice from strongly agree (SA), agree (A), undecided (U), disagree (D) or strongly disagree (SD). In the mid-treatment survey, I condensed questions four and seven into one as I thought they were asking for the same information. Three other questions in the pre-treatment survey, four in the mid-treatment survey and five in the post-treatment survey were free response questions.

Teacher daily journal and CAT's were extensively used throughout the treatment phase to provide answers to my research questions. An important source of qualitative data was the free response section of the surveys, which was reinforced by student interviews that were conducted at least twice during the period of the research. I conducted my interviews either after a survey or after a major test. This was done to ensure that students could easily relate the interview questions to the treatment while still fresh in their minds. A combination of all the different data collection methods and the use of the same instrument several times over during the research period, including having my instructor and colleagues look at my instruments helped insure validity and reliability of my instruments.

The research methodology for this action research project received an exemption by the Montana State University's Institutional Review Board (Appendix G), and compliance for working with human subjects was maintained.

DATA AND ANALYSIS

As mentioned earlier, a lot of the data was collected through daily quizzes as well as other data collection instruments. In this section, data collection and analysis will be described in detail. Data collected from daily quizzes was entered into a spreadsheet. The results of each week were averaged, and the frequency distribution was calculated showing the number of students who scored within a given range of scores. The results for eight weeks of treatment are shown in Table 2:

Table 2
Average quiz scores (N = 56-63)

Range (%)	40-49	50-59	60-69	70-79	80-89	90-100
Week 1	0	3	7	13	27	11
Week 2	1	2	1	10	17	32
Week 3	0	1	2	6	27	27
Week 4	0	3	7	15	27	6
Mean of each range	0.25	2.25	4.25	11.0	24.5	19.0
Week 5	0	1	3	5	20	33
Week 6	0	1	0	4	28	23
Week 7	0	0	2	5	20	35
Week 8	0	0	4	8	15	33
Week 9	0	0	0	9	33	21
Mean of each range	0.0	0.4	1.8	6.2	23.2	29.0

The table shows that the quiz grades generally increased through each week of treatment, with the exception of week four, where 72% of the students scored between 70% and 89%. This could be attributed to the fact that during that week, I was teaching genetics, and from my discussion with the students, they admitted that they were having a hard time understanding associated vocabulary. For example, one student said “I am having a hard time understanding the difference between transcription and translation. I keep on mixing them up.” There was a strong support for this student’s statement from

other students, and consequently, the students suggested that I re-teach this concept. This is one of the things that helped me to improve instruction, which was one of my sub-questions.

Table 2 also shows that week five through nine had the greatest improvement with over 85% of the students scoring between 80 and 100 percent. It is also worth noting that the number of students scoring less than 70% is significantly lower across the nine week period with only about 16% of students scoring lower than 70% in week one, which reduced to between 3% and 6% by week nine. Significantly, no student scored below 60% in week seven and eight, and in week nine, no students scored less than 70%.

Another key finding that can be seen from Table 2 is the mean distribution across the each quiz range when grouped in to two categories: Week one to four and week five to nine. It is clear that the performance was much better in the second five weeks than in the first four weeks. For example, the mean score in the 90-100 score range was 29 in the second five weeks compared to only 19 in the first four weeks. On the other hand, the total mean score in the 40-49 and 50-59 score range was only 0.4 in the second five weeks compared to 2.5 in the first four weeks. Similarly, the total mean score for those who scored less than 70% was a paltry 2.2 in the last five weeks compared to a massive 6.75 in the first four weeks. All this provides evidence that daily quiz scores improved as the treatment progressed.

Over the seventeen week treatment period, students took six major tests. The first test was administered after two weeks of treatment (Test 1), and the rest of them were

administered in three week intervals. Table 3 shows grade distribution in the six major tests.

Table 3*:*
Test Scores (N=50-61)

Range %	40-49	50-59	60-69	70-79	80-89	90-100	Mean
Test 1	5	12	24	11	9	0	65
Test 2	3	7	16	16	15	4	72
Test 3	2	5	11	16	12	15	75
Test 4	1	3	16	21	9	9	75
Test 5	6	14	10	8	12	0	67
Test 6	2	0	3	16	15	18	83

The test scores were then compared in a stacked graph as shown in *Figure 1*:

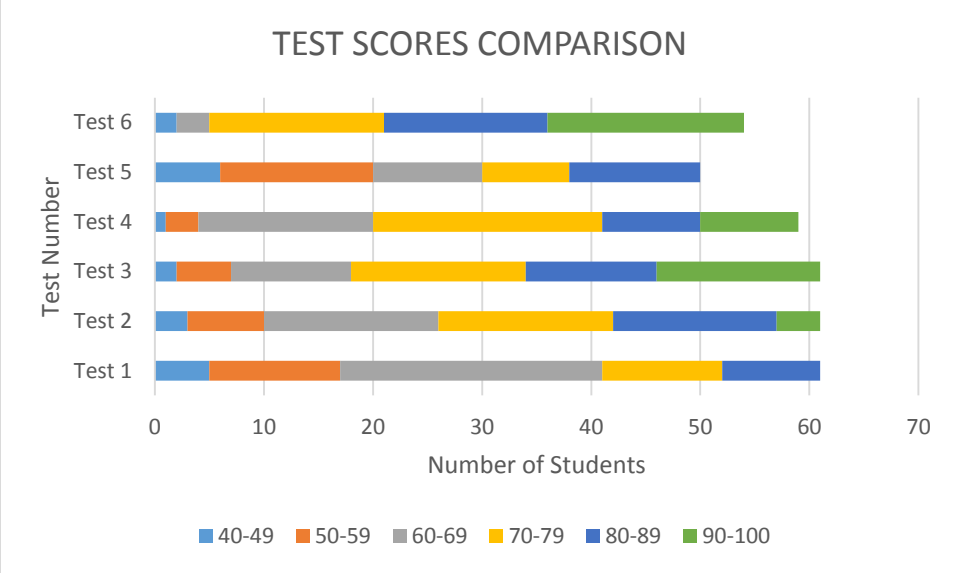

Figure 1: Test scores comparison, (*N* = 50-61).
Test 1: Scores after 2 weeks of treatment
Test 2: Scores after 5 weeks of treatment
Test 3: Scores after 8 weeks of treatment
Test 4: Scores after 11 weeks of treatment
Test 5: Scores after 3 weeks of non-treatment (week 14)
Test 6: Scores after 3 weeks of re-introduction of treatment (week 17)

Figure 1 shows that there was a significant improvement in student test scores over the treatment period. For example, between week two and eight, the number of students who scored below 70% decreased from 41 to 18, which was a 37% decrease, while the number of students who scored above 70% increased from 20 to 43, which translates to a massive 70% increase. Within the same period, the mean score also increased from 65% in week two to 75% by week eight. Significantly, the number of students who scored above 90% increased from zero after two weeks of treatment, to 15 after eight weeks of treatment.

Another significant finding is that between weeks eight and eleven which showed that besides the mean score remaining constant at 75%, the number of students who scored below 70% was approximately equal. I am not sure whether this would mean that the effect of the daily quizzes have reached their maximum threshold or whether it was just a coincidence. Test four was also the end of semester one exam.

Perhaps the greatest finding was what I discovered between test five and six. Both tests were administered in the second semester. The students had by this time started complaining that I was giving them too many quizzes. From the beginning of my project, I had wanted to have some kind of a control that would help me to have some comparable data. Therefore, this provided me with an opportunity to test my treatment. As part of a control experiment, I decided that I was not going to give daily quizzes for three weeks. However, I did not tell the students that. As they were used to taking daily quizzes, every time they would come to my class they would ask, “Do we have a quiz today?” I continued to teach normally and gave students regular class assessments.

At the end of three weeks, I administered test number five. The results of this test are captured in Table 3 and *Figure 1*. For a quick comparison, *Figure 2* below shows the grade distribution between the non-treatment and the treatment scores (Test 5 and 6):

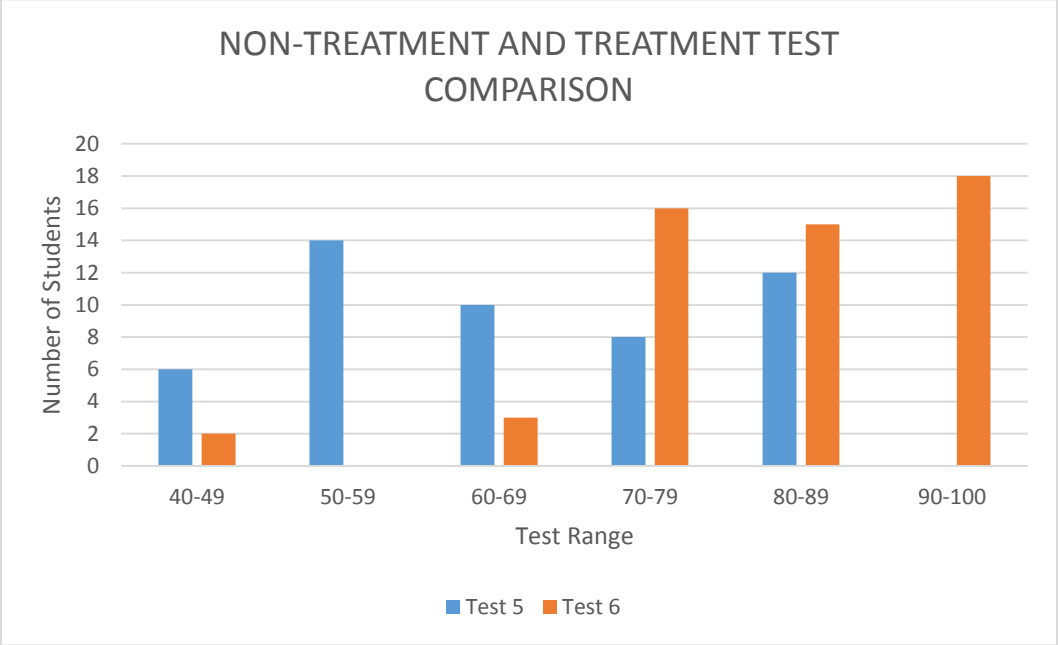

Figure 2: Non-treatment and treatment score comparison, (*N* = 50-54). Test 5: Scores after 3 weeks of non-treatment. Test 6: Scores 3 weeks after re-Introduction of treatment.

From these results, it was clear that student performance had gone down drastically after three weeks of non-treatment (Test 5). For example, 60% of the students scored below 70% while no student scored above 90%. The mean score went down to 67%. These scores were very comparable to the scores registered in test one, which was given two weeks after the beginning of my treatment (which was some kind of baseline data). I carried out a quick poll after this test to assess students' opinions regarding their performance and whether we should re-introduce daily quizzes. A significant 89% of the students thought daily quizzes were helpful in helping them pass tests. One student for

example said “They help me to remember things,” another one said “They constantly refresh the things I have learned,’ while yet another one replied “Daily quizzes help me to retain information better.”

Of the few who did not think daily quizzes would help, one student said “Because if I don’t know the information in a quiz, I am probably not going to know it on a test.” I made a quick follow-up with this student, who coincidentally happens to be the one who consistently scored the lowest grade in the tests. An informal interview with her failed to reveal much as she was not willing to tell me why she thought daily quizzes were not helpful.

At this point, I knew the students were ready for daily quizzes to be re-introduced, which I did immediately after. Three weeks later (week 17), I administered test number six, and the results were higher than at any other time during my treatment period. As shown in Table 3 and captured in *Figure 1* and *Figure 2*, over 33% of the students scored above 90% with five students scoring 100%. On the other end of the spectrum, only five students, representing about nine percent, scored less than 70%. The mean score also went up from 67% to 83%, which was the highest ever throughout my treatment period. These results clearly showed that daily quizzes have a significant effect on student performance, which was my main focus question. These results also agree with the findings of Poljicanin, A, et al., (2009).

The results of the pre-treatment, mid-treatment and post-treatment survey were entered into a table and analyzed based on percentage of students who agreed, were

undecided, or disagreed with each of the eight survey questions. The survey questions are listed below (and a complete survey is provided in Appendix C and Appendix D):

1. I participate often in biology.
2. I feel confident in my ability to do well in biology.
3. Daily quizzes motivate me to study and understand concepts taught.
4. I understand the concepts on a biology quiz or test very well before I take it.
5. Daily quizzes help me to prepare for my tests.
6. I prefer taking daily short quizzes covering less information while it is fresh in my mind
7. I feel confident in my understanding of a topic before taking a quiz or test
8. How I perform on a test is a good indicator of what I know.

Table 4 shows the results of the survey:

Table 4:
Percentage agreement, undecided and disagreement, (N = 61).

Question #	Agree			Undecided			Disagree		
	Pre	Mid	Post	Pre	Mid	Post	Pre	Mid	Post
1	59%	63%	75%	33%	30%	18%	8%	7%	7%
2	69%	72%	74%	27%	19%	20%	3%	9%	7%
3	71%	67%	74%	15%	28%	20%	14%	5%	7%
4	73%	63%	66%	21%	32%	30%	6%	5%	5%
5	76%	88%	87%	17%	7%	11%	6%	5%	2%
6	67%	81%	82%	22%	16%	16%	11%	3%	2%
7	66%	52%		28%	40%		6%	8%	
8	90%	84%	74%	8%	12%	18%	2%	4%	8%

Table 4 shows that the degree of agreement with all the eight questions was much higher than either the undecided or the disagreement. For questions one, two, three, five

and six, the degree of agreement also increased between the pre-treatment and post-treatment indicating that the students progressively viewed the treatment positively. Questions four and seven were merged in the post-treatment phase because they seemed to be asking the same thing. For these two questions and question eight, the percent agreement went down indicating that students were either feeling overwhelmed by the content because the quizzes increasingly covered more topics, or they just felt inadequate in their understanding of biology concepts.

The results of the survey were also coded by assigning numbers one through five for each of the responses: strongly disagree (SD), disagree (D), undecided (U), agree (A) and strongly agree (SA) respectively, in order to easily compare the effects of the treatment. A complete analysis is shown in Appendix G. Table 5 shows a comparison of the average coded results:

Table 5
*Average Survey Responses Pre-Treatment and Mid-Treatment (Pre-Treatment, N =*62*, Mid-Treatment, N =* 58*, Post-Treatment, N =* 61*)*

Question #	Pre-Treatment	Mid-Treatment	Post-Treatment
1	3.6	3.7	3.8
2	3.9	3.8	3.8
3	3.8	3.9	3.7
4	3.8	3.7	3.6
5	4	4.2	4
6	3.8	4.1	4
7	3.7	3.6	
8	4.2	4.2	3.8

SA = 5, A = 4, U = 3, D = 2, SD = 1

These results can also be presented using a bar graph for ease of comparison as shown in *Figure 3*:

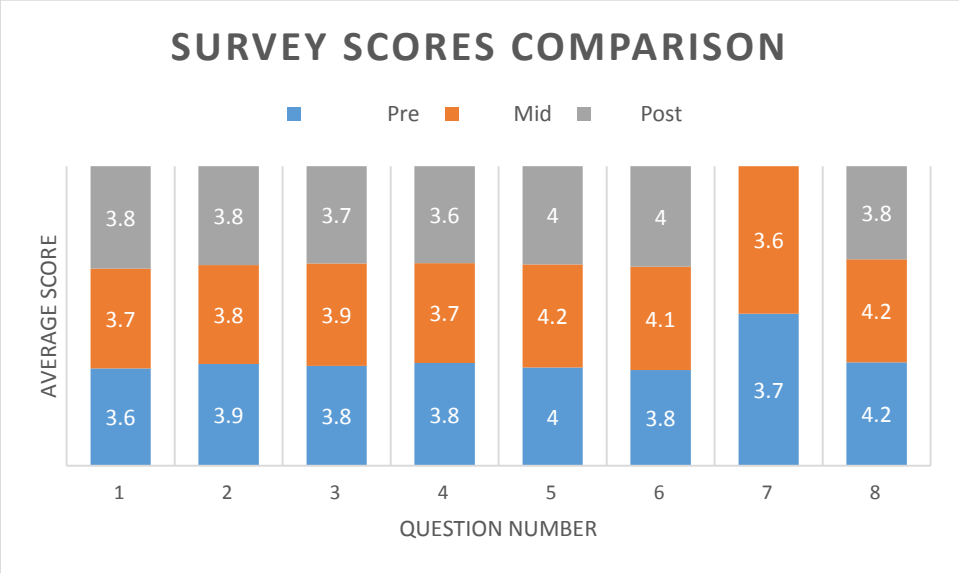

Figure 3. Survey comparison (pre-treatment, *N* = 62, mid-treatment, *N* = 58, post-Treatment, *N* = 61).

Table 5 and *Figure 3* show that there is an overall agreement with each of the eight survey questions. Question five, six and eight had the highest degree of agreement, indicating that the students viewed daily quizzes as an important tool not only for preparing them for tests, but also for helping them evaluate themselves on what they know and what they need to work on. Furthermore, students seem to have a strong preference for shorter quizzes covering less information than longer less frequent quizzes. While this is good in the short term, I think it is important that students get used to taking both shorter and longer quizzes covering more information, including information that was covered several months earlier, as this would help to improve their retention.

In order to have a better comparison between the various components of the survey, the questions were weighted by assigning a two to strongly agree, one to agree, one to disagree and two to strongly disagree. The results are shown in Table 6.

Table 6:
Weighted Survey Responses Pre-Treatment and Mid-Treatment (Pre-Treatment, N =62, Mid-Treatment, N = 58, Post-Treatment, N = 61)

Question #	Agree			Disagree		
	Pre	Mid	Post	Pre	Mid	Post
1	1.1	1.1	1.2	1.0	1.0	1.0
2	1.3	1.1	1.2	1.5	1.0	1.0
3	1.3	1.3	1.2	1.1	1.0	1.2
4	1.1	1.0	1.1	1.0	1.0	1.0
5	1.5	1.3	1.2	1.0	1.0	1.0
6	1.3	1.2	1.2	1.0	1.0	1.0
7	1.1	1.1		1.0	1.0	
8	1.3	1.3	1.2	1.0	1.5	1.2

SA = 2, A =1, D = 1, SD = 2

These results show that there was a higher degree of agreement with most of the survey questions than there was disagreement. For example, the degree of agreement for questions one, three, five, six and seven was 0.1 to 0.5 higher than the degree of disagreement. An interesting finding is in question two, where during the pre-treatment survey, 1.5 of the responses indicated disagreement showing that many students did not feel confident about their ability to pass biology. However, this score sharply came down to 1.0 during mid and post-treatment period indicating that daily quizzes helped to increase student confidence in their ability to pass biology. The table also shows that there were equal scores for question eight during the post survey with both agree and disagree scoring 1.2, suggesting an equal number of students thought their performance in tests was a good indicator of what they know, as are those who did not think so.

However, there was a 0.3 drop in the degree of disagreement between the mid and the post survey compared to a 0.1 drop in the degree of agreement which remained fairly constant throughout the treatment period.

Discussion

The results of the quizzes and the benchmark tests show some very interesting trends. First, there seems to be a general increase in the number of students with higher scores in their quizzes. As Table 1 shows, the average quiz scores increased as treatment progressed. While this increase was not linear, it showed that daily quizzes do have a positive effect on student learning. This helped to answer one of my research questions which asked whether daily quizzes motivate students to study. By scoring higher quiz grades in successive weeks of treatment, it can be concluded that students are reviewing their notes more and studying more. This was also supported by student responses to survey question number three where one student wrote "I know there will be a quiz, so I'm motivated to study even if I don't understand", while another student wrote "Because they help me understand things that I didn't."

The results of the survey were also used to provide answers to three of my sub-questions. On whether the daily quizzes change student attitudes and motivation to study for example, 71% *(N = 61)* of the students agreed on the pre-treatment survey, but this number went down to 67% during the mid-treatment survey. Some of the reasons given by students for this decline included a concern regarding their overall class grades. For example, one student, while supporting her undecided response stated that "I don't know

because we take a lot of quizzes and bring down my grade", while another one disagreed and said that "It just makes me worry about I'm gonna fail it or not."

Asked whether "daily quizzes help me to prepare for my tests." a whopping 88% of the students were in agreement in the mid-treatment survey, compared to 72% in the pre-treatment survey. This represents a 12 percentage point increase in the number of students who thought daily quizzes do help in preparing them for the tests. For example, one student wrote, "The quizzes almost mirror the test, and are very helpful", yet another one wrote, "They keep things fresh in your mind." Another student replied and said "Yes because the quizzes take a little information, so little by little, I get all the information for the test." These students' observations were strongly supported by my daily teacher journal entries where I routinely observed students rushing to class before the tardy bell rings, and most of them would quickly go over their notes before the daily quiz began. Student interviews also reinforced the fact that daily quizzes are helping the student prepare for tests. For example, the most obvious theme from my interviews was that "Daily quizzes help to keep the material fresh in my mind," in the words of one student, "a fact that made it easier to pass my tests." This finding was also consistent with the finding of Norton (2009).

On whether daily quizzing helped to improve student retention of learned concepts, most students thought they do. For example, one student wrote, "Yes, because the quizzes are like a practice for improving my knowledge and then I can do it over and over." Another student wrote, "Yes, because they are a great reminder and practice of a recent lesson", yet another one wrote, "Yes because it helps to review and keep things

fresh in my mind." Overall, the degree of agreement was much higher than that of undecided or disagreement in the three treatment phases in all the eight questions asked as shown in Table 6. This shows that, students view the treatment favorably, although they have their own concerns.

INTERPRETATION AND CONCLUSION

My main focus question looked at the effect of daily quizzes on student performance in science exams. Perhaps, the best indication that the quizzes do have an effect can be clearly seen from the results of Table 3 and *Figure 1*. The results show that after eight weeks of treatment, the performance in a major benchmark test is significantly higher than after two weeks of treatment. As mentioned earlier for example, students who scored less than 70% significantly reduced from 41 in Test one to 18 by Test three, a 37% decrease, while the number of students who scored higher than 70% increased from a low of 20 to a high of 43 within the same period, representing another 70% increase. Significantly, 15 students scored between 90 and 100 percent after eight weeks of treatment, while there were no students who scored above 89% after two weeks of treatment. The results also showed that the class average increased from 63% to 75% within the same period, which was a 12% increase.

While test scores do not show a significant change after eleven weeks of treatment as shown by the data on test four, the results of tests five and six provide us with one of the more striking effects of the treatment. As mentioned earlier, when no treatment was done for three weeks, the scores were significantly lower (Test 5), but when the treatment was re-introduced, the scores increased significantly to the highest

level over the entire treatment period (Test 6). This difference in score between tests five and six also caused the students to appreciate the significance of daily quizzes in helping them be successful in their exams.

Based on the fact that the students scored higher quiz grades in successive weeks of treatment as shown in Table 2, I can conclude that students are reviewing their notes more and studying more. The survey results shown in Table 4 also show that 71% of the students agree that daily quizzes motivate them to study during the pre-treatment survey. Although this figure went down to 67% by mid-treatment, it went back up to 74% by post-treatment. Significantly, the percentage of those who disagreed went down more substantially from 14% during pre-treatment to only 5% and 7% by mid and post-treatment respectively, representing an overall five percentage point gain. As mentioned earlier, some of the reasons given by students for this decline included a concern regarding their overall class grades. For example in response to question three, one student who was undecided stated "I don't know because we take a lot of quizzes and bring down my grade", while another one disagreed and said that "It just makes me worry about I'm gonna fail it or not."

On how I can use daily quizzes to improve instruction, one way is by looking at their daily scores. Whenever the scores are low, I take time to either talk to the students or to review or re-teach certain concepts. Many times, I discovered that the students had a misconception, or a misunderstanding and daily quizzes helped me to catch these well in advance and address them immediately. For example, from one of our discussions, I gathered that students thought I was teaching too fast, and that they do not have time to

synthesize what they learned the previous day before I taught them a new concept. In order to improve instruction therefore, I had to adjust my pace (even though I am under pressure from the District because we have to follow the District Pacing Calendar), and also provide more opportunities for addressing student questions and concerns.

Question eleven on the student survey helped to answer the question on whether daily quizzing helped to improve student retention of learned concepts. In response, most students thought they did. For example, one student wrote, "Yes, because the quizzes are like a practice for improving my knowledge and then I can do it over and over." Another student wrote, "Yes, because they are a great reminder and practice of a recent lesson", yet another one wrote, "Yes because it helps to review and keep things fresh in my mind."

The results of my AR are very significant in shaping the way I will be teaching in the future. I have learned a lot about student learning and I believe that this research has provided me with the tools necessary to be a successful teacher. Before I carried out this research, I just taught and kept on going. The only time I would receive feedback is when I gave that chapter test or quiz after several weeks. Most of the assessment was done through assignments, and even then, I did not take much time to think about how students are being impacted by my teaching. By carrying out this research, I have learned that regular feedback is the key to a successful classroom.

Another key finding of my research is that students do want to play a role in their education. By providing them with opportunities to provide feedback, either through surveys, interviews or any other means, and seeing that you do value their feedback and

are actually implementing some of their recommendations, they are more likely to respond to your teaching and hence improve on their own learning. I plan to continue improving on my teaching by providing these opportunities to my students. Even though I may not be collecting data for in-depth analysis, I will continue to conduct daily quizzes and some CAT's in order to quickly gather data on student feelings regarding my teaching and opportunities for continuous growth and improvement.

One of the key findings of my study which I captured in my daily teacher journal entries was that daily quizzes are far more effective as a tool for beginning class than the traditional "Warm-Ups" or "Bell Ringers." While the quizzes kept the students engaged right from the beginning of the lesson when they would rush to class and get ready for the timed daily quiz, the same cannot be said for warm-ups which students stop taking seriously after a few weeks of school. The results of tests five and six also provide enough evidence that daily quizzes help students improve on their performance, and so I would continue to give quizzes on the same frequency.

The value of my research to my colleagues, administrators and other educators cannot be overemphasized. It is every educator's desire to see their students succeed. By implementing some of the strategies that I used for my AR, many educators can see increased performance on their students, especially those that take end of course exams or end of semester exams. There is also an improved degree of motivation to study and responsibility for learning on the part of the students which is a huge concern for most educators. Equally important, my AR has also provided some of the data required by the

administration to request those daily quizzes as part of a strategy to improve student performance since that was one of the reasons I decided to carry this action research.

VALUE

Since my research was carried out entirely in the classroom, it has great value to any classroom researcher that wants to either carry out a similar study, or improve on my research. There are several variables that can be changed in the research. For example, while there was overall improvement in student performance as the treatment progressed, this may not always be the case because the topics taught are not always of the same degree of difficulty. The number of questions asked, the time given for the quizzes and the level of ability of the students may also be factors that may need to be factored in by other classroom researchers. Overall, however, the results of this research can easily be generalized to other classrooms and schools.

My AR has generally affected the way that I teach now, and will be teaching in the future. Rather than give the popular 'Warm-ups", which from experience really lose meaning a few weeks into the school year, I would rather do something that would make the students to have reason to think and study. As the daily quizzes do affect their grades, they are more likely, and I have already experienced this, to take them seriously. One thing that has also helped is timing the quizzes. Having a countdown timer visible for all students instills in them a sense of urgency to get to class on time and be ready for that quiz. The behavior of the students at the beginning of class has dramatically changed as no student wants to miss the quiz or find the timer on when they get to class. Students

know they will be assigned a grade, so they want to be on time so that they can utilize all the time given for the quiz.

Throughout my research, I also learned to make quizzes very deliberate. It would be a good idea to have all the quizzes set at the beginning of the week. Although they can be changed (just like lesson plans), planning ahead always gives you more flexibility to change things around if need be. Looking at the test scores at the beginning of the study (Test 1) and the results of tests five and six, it is clear that with daily quizzes, students get better scores indicating that deliberately planning for these quizzes would get them better prepared. The next steps would therefore be to re-write my lesson plans to include daily quizzes, either at the beginning or end of class. Having students, parents, and administrators buy into this idea may also be a good next step in ensuring success of any future research. My research could be used to provide that important data required to justify the use of this strategy.

Finally, I completed my data collection in early December, just before the students took their semester final exams. However, since I wanted to see the effect that the daily quizzes would have on student performance in end of course exams, normally taken in early May, I continued with the treatment right through the end of February. March is normally a time when students go for Spring break and some school field trips, so our schedules get changed to provide more time for end of course (EOC) exam preparation. Students also start taking EOC's in March, and all efforts are normally directed to the English EOC exams which come first. My support team was also involved throughout the action research process.

Throughout my AR project, I gave the daily quizzes primarily at the beginning of class. I did give a few quizzes at the end of class before students left for the next period, but I didn't think these quizzes were as effective as the ones at the beginning. This was probably because the students were eager to get out and go to their next class. Some questions that might require further study would therefore be like what effect would daily quizzes, given at the end of class have on student performance. Another topic of study might be to address the pros and cons of both types of quizzes with the aim of coming up with the best strategy that would produce maximum student output.

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APPENDICES

APPENDIX A

SAMPLE DAILY QUIZZES

Sample Daily Quizzes

Cell Structure & Function Quiz #1 **Time: 8 minutes**

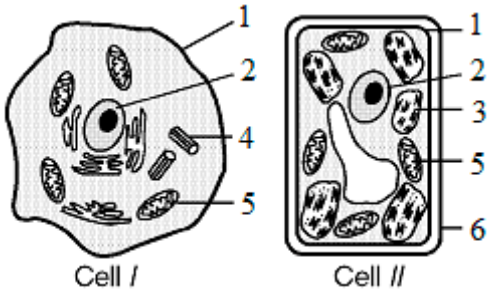
1. Which organelles are most directly involved in transporting materials out of the cell?
A. Nucleus and Ribosomes
B. Chloroplast and Mitochondria
C. Cell Membrane and Cell wall
D. Golgi apparatus and Cell Membrane

2. Which organelle is the site of cellular respiration in both animal AND plant cells?
A. Nucleus
B. Chloroplasts
C. Mitochondria
D. Vacuole

3. Which statement BEST describes the cell membrane in a typical plant cell? The membrane
A. selectively controls what enters and exits the cell.
B. is composed of protein and carbohydrates only.
C. has the same permeability to all substances moving in and out the cell.
D. is a composed of two protein layers with lipids floating inside.

4. Which organelle is responsible for photosynthesis?
A. Nucleus
B. Chloroplasts
C. Mitochondria
D. Vacuole

5. In the diagram below, Cell I and II represent typical cells.



In both cells, organelle 5 is the site of

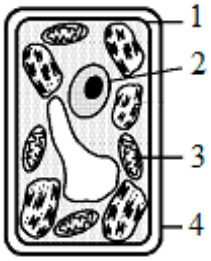
A. photosynthesis .
B. cellular respiration.
C. resource storage.
D. protein synthesis.

6. If the ribosomes stop working in a cell, which cellular process would be most directly affected?
A. Photosynthesis
B. Aerobic respiration
C. Protein synthesis
D. Excretion of cellular wastes

7. Which of the following is present in a typical plant cell but NOT in an animal cell?
A. Mitochondria
B. Cell Wall
C. Ribosome
D. Golgi Apparatus

8. Which organelle functions in the storage of water and biomolecules?
A. Vacuole
B. Cell Wall
C. Endoplasmic Reticulum
D. Chloroplast

9. Use the following diagram to answer the next question.



This cell is most likely a plant cell because it contains

A. Structure 1.
B. Structure 2.
C. Structure 3.
D. Structure 4.

10. Plants are unable to move to a new location in response to changes in their environment. Which of the following organelles plays a role in maintaining homeostasis in a plant?

A. Cell Wall
B. Chloroplast
C. Vacuole
D. Nucleus

Cell Structure & Function Quiz #2 **Time: 8 minutes**

True/False: Circle either true or false for each statement. If the statement is false, change the underlined word or phrase to make it true.

1. The organelle that controls what gets into the cell is called the cell membrane.
True False

2. Organelles that use energy from sunlight to produce food are called mitochondria.
True False

3. The Cell Theory states that cells are produced from non-living things.
True False

Multiple Choice: Circle the letter that best answers the question.

1. Which of the following statements is a part of the Cell Theory:

a. Only plants are composed of cells.

b. All cells are produced from other cells.

c. Cells can be produced from non-living matter.

d. Cells are the only unit of structure and function in all living things.

2. Which of the following statements is NOT a part of the Cell Theory:

a. Cells are the basic unit of structure and function in all living organisms.

b. All cells are produced from other cells.

c. Only animals are composed of cells.

d. All living things are composed of cells.

3. What is the function of the cell membrane?

a. To protect and support the cell.

b. To perform different functions in each cell.

c. To control what enters and leaves the cell.

d. To form a hard outer covering for the cell.

4. Which organelle is the control center of the cell?

a. Mitochondrion

b. Ribosome.

c. Nucleus.

d. Chloroplast.

5. Which organelles produce most of the energy needed by a cell?

a. Mitochondria

b. Chloroplasts.

c. Ribosomes.

d. Golgi Bodies.

6. Which organelles produce proteins in the cell?

a. Golgi Bodies.

b. Chloroplasts.

c. Ribosomes.

d. Vacuoles.

7. How does a bacterial cell differ from an animal cell?

a. It is larger.

b. It does not have a nucleus.

c. It has no cytoplasm.

d. It has no organelles.

Cell Structure & Function Quiz #3 **Time: 7 minutes**

Multiple Choice: Cirlce the correct answer

1. Which organelles found in plant and animal cells are also found in bacterial cells.

a. Endoplasmic reticulum.

b. Golgi Bodies.

c. Chloroplasts.

d. Cytoplasm.

2. What is the function of a cell wall?

a. To support the cell and give it its shape.

b. To perform different functions in each cell.

c. To prevent water from passing through it.

d. To prevent oxygen from entering it.

3. Which organelles store food and other materials needed by the cell?

a. Mitochondria.

b. Chloroplasts.

c. Ribosomes.

d. Vacuoles.

4. Which organelles contain chemicals that break down large particles into smaller ones?

a. Endoplasmic Reticulum.

b. Golgi Bodies.

c. Lysosomes.

d. Vacuoles.

Matching: In the blank, write the letter that matches the definition.

_____1. Transports materials through the cell	a. mitochondria
_____2. Sacs that store materials in a cell	b. cell membrane
_____3. Small organelle that contains chlorophyll	c. vacuoles
_____4. Outermost part of an animal cell	d. cytoplasm
_____5. Produces most of the cell's energy	e. nucleus
_____6. Cell material that holds other organelles	f. endoplasmic reticulum
_____7. Outermost part of a plant cell	g. cell wall
_____8. Controls all of the cells' functions	h. chloroplast

Quiz #4 **Time: 5 minutes**

Fill in the Blanks: In the blank, write the word or phrase that best completes the statement.

1. According to the Cell Theory, all organisms are made up of _____

2. The structure that allows materials to pass in to and out of a cell is the _____

3. Small, round organelles called _____ produce proteins inside cells.

4. Organelles known as _____ contain chemicals that break down food particles and old cell parts.

5. Unlike in an animal cell, the DNA in a bacterial cell is not found in a(n) _____

6. A structure found in plant and bacterial cells, but NOT in animal cells is the _____
_____

Cell Structure & Function quiz #5 Time: 5 minutes

1. What is the smallest, most basic unit of life?
_____

2. Where is the DNA in a prokaryote? in a eukaryote?
_____
_____
_____
_____

3. Why would you need a microscope to see a prokaryotic organism?
_____
_____
_____
_____

4. A friend tells you he read somewhere that rotting garbage can turn into maggots, which are fly larvae, and the maggots then can grow into adult flies. What part of the cell theory could you use to refute his claim?
_____
_____
_____
_____

QUIZ #5 **Time: 7 minutes**

MAIN IDEA: Early studies led to the development of the cell theory.
In a phrase, tell what each scientist did to help develop the cell theory.

Scientist	Contribution to Cell Theory
1. Hooke	
2. Leeuwenhoek	
3. Schleiden	

4. Schwann	
5. Virchow	

What are the three parts of the cell theory?

_____

_____

_____

_____

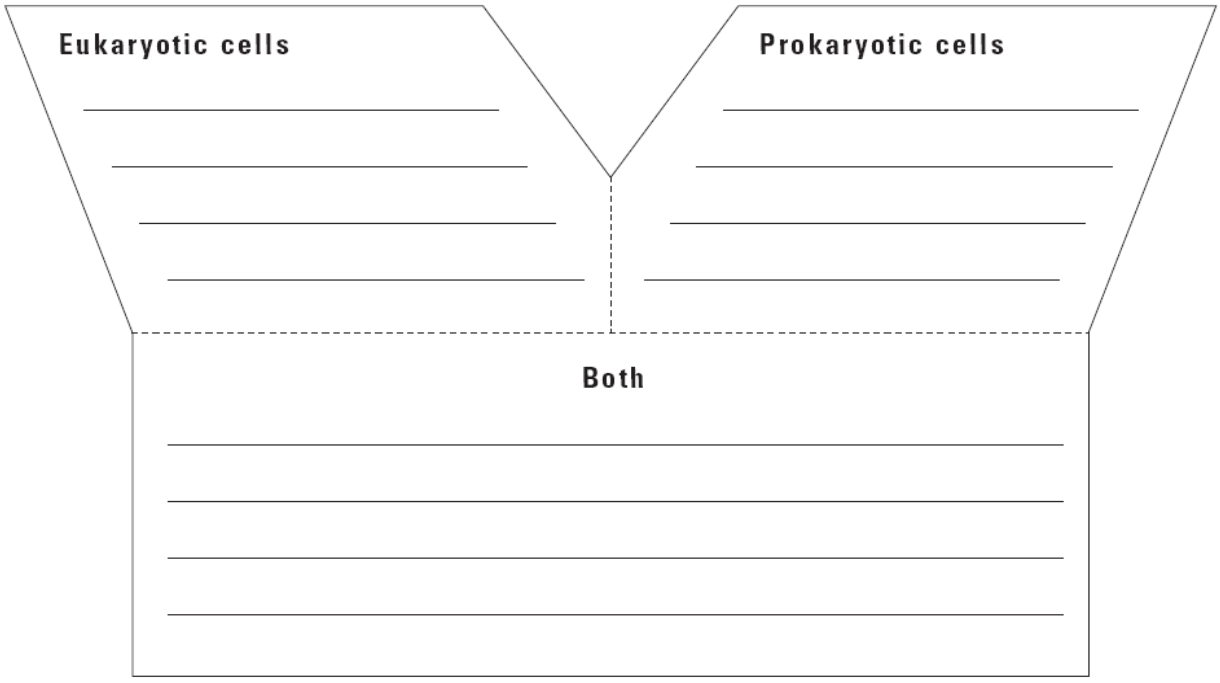
_____

_____

Quiz #6 Time: 5 minutes

MAIN IDEA: Prokaryotic cells lack a nucleus and most internal structures of eukaryotic cells.

In the top left side of the Y shape below, write the characteristics of eukaryotic cells. In the top right side of the Y shape below, write the characteristics of prokaryotic cells. At the bottom of the Y shape below, write the characteristics that both kinds of cells have in common.


Eukaryotic cells
Prokaryotic cells
Both

APPENDIX B

SAMPLE TEST

Sample Test

CELLS, VIRUSES AND BIOMOLECULES TEST: WEEK 4, 2014

1. The protein coat that surrounds the nucleic acid core of the virus is called a:

A. Capsid B. Viroid C. Prion

2. Which cycle causes the host cell to lyse (burst)?

A. Lytic cycle B. Lysogenic cycle

3. Water moves into a cell placed in a(n) _____ solution.

a. osmotic
b. hypertonic
c. hypotonic
d. isotonic

4. If a cell is placed in salt water, water leaves the cell by _____.

a. osmosis
b. diffusion
c. active transport
d. phagocytosis

5. Which of the following requires energy?

a. facilitated diffusion
b. endocytosis
c. diffusion
d. osmosis

6. What is the name of the enzyme in retroviruses that causes DNA to be made from RNA?

A. Retroenzyme B. Reverse transcriptase C. Backwardsenzyme

7. What is the name of the viruses that infect bacteria?

A. Bacteriophage B. Herpes virus C. Chickenpox

8. What is used to prevent viral diseases?

A. Vaccines B. Antibiotics C. Allergy medication

9. HIV (human immunodeficiency virus) causes the disease known as:

A. AIDS B. Smallpox C. Hepatitis

10.

Biomolecule	Structural Feature
Carbohydrates	Contain carbon, hydrogen, and oxygen in a 1:2:1 ratio, respectively
Lipids	Consist mostly of carbon and hydrogen with little oxygen
Proteins	Formed by joining amino acids
Nucleic acids	Contain only nitrogen bases, abbreviated A, T, G, and C

Which biomolecule did the student describe incorrectly?

A. Carbohydrates **B.** Lipids **C.** Proteins **D.** Nucleic acids

67% NaCl

11. In the figure above, which way will the water move?

a. into the cell
b. out of the cell
c. equally into and out of the cell
d. none of these

12. In the figure above, the cell is in what kind of solution?

a. hypotonic
b. hypertonic
c. isotonic
d. homeostasis

13. Both animal cells and plant cells are examples of eukaryotic cells. They are both classified as eukaryotic cells because they –

A. perform energy conversions
B. have a cell membrane
C. contain a membrane-bound nucleus
D. maintain homeostasis

14. The human immunodeficiency virus (HIV) causes a disease known as acquired immune deficiency syndrome (AIDS). This disease results from the destruction of white blood cells known as T4 cells. Which feature of viruses best explains how HIV destroys white blood cells?

A. Viruses are not considered living.
B. Viruses are smaller than prokaryotic cells.
C. Viruses can enter the lytic cycle after infecting a cell.
D. Viruses do not contain any organelles.

15. Carbohydrates, lipids, proteins, and nucleic acids all contain the elements carbon, hydrogen, and oxygen. However, two types of these biomolecules also contain the element nitrogen. Which two types of biomolecules also contain nitrogen?

A. Lipids and carbohydrates

B. Carbohydrates and nucleic acids
C. Proteins and lipids
D. Nucleic acids and proteins

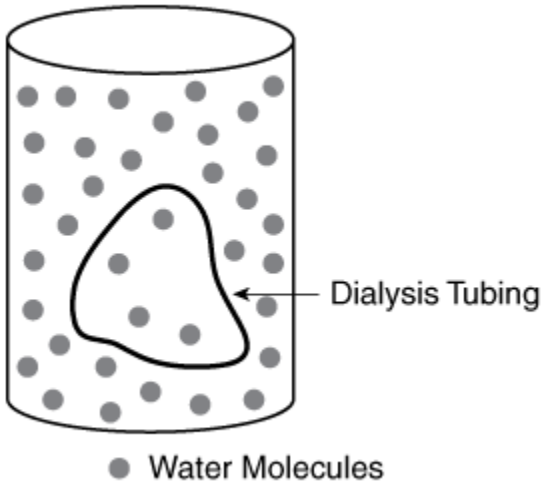
16. A student was examining a cell under a microscope. She labeled the cell as a prokaryotic cell. What did this student notice about this cell to cause her to label it this way?

A. The cell did not have a nucleus.
B. The cell was highly organized.
C. The cell was surrounded by a cell wall.
D. The cell was in the process of dividing.

17. The cell theory does not include viruses. Why?

A. Viruses do not contain genetic information.
B. Viruses do not contain organelles such as nuclei.
C. Viruses are not considered living things.
D. Viruses cannot reproduce.

18. A student set up a model of a cell by using a piece of dialysis tubing. The student filled the tubing with a salt solution and then placed it in a beaker of water. The illustration below shows the difference in the concentration of water between the inside and the outside of the tubing.



Predict what will happen to the model of the cell in this experiment.

A. Water will move into the dialysis tubing, causing it to swell.
B. Water will move into the dialysis tubing, causing it to shrink.
C. Water will move out of the dialysis tubing, causing it to swell.
D. Water will move out of the dialysis tubing, causing it to shrink.

19. Organic compounds found in living things are known as biomolecules. Which biomolecule represents the main source of energy that living things use for respiration?

A. Proteins **B.** Nucleic acids **C.** Carbohydrates **D.** Lipids

20. In 1952, scientists conducted an experiment involving bacteria and viruses. Based on their results, they concluded that the genetic information was stored in —

A. a nucleic acid **B.** a carbohydrate **C.** a protein D**.** a lipid

21. In the 1860s, Louis Pasteur established the germ theory of disease. Germs are organisms that cause disease. Scientists refer to germs as pathogens. Viruses are pathogens because they cause disease. Which of the following diseases is not caused by a virus?

A. Strep throat **B.** Common cold **C.** AIDS **D.** Influenza

22. Which statement is a fundamental principle of the cell theory?

a. All cells have a plasma membrane.

b. Eukaryotic cells are larger than prokaryotic cells.

c. Living organisms are composed of cells.

d. The genetic material in cells is DNA.

23. A plant cell is placed in a hypotonic solution. What will happen to the plant cell?

a. It will swell.

b. It will shrink.

c. It will stay the same.

d. It will wilt.

24. Hooke's discovery of cells was made observing

a. living algae cells.

b. human blood cells.

c. cork cells

d. skin cells.

25. Most virses have the structural arrangement of

o a cell wall surrounding the cell membrane

o a protein coat surrounding a capsid

o flagella surrounding the cell membrane

o a capsid surrounding a nucleic acid sequence

26. Lysogenic viruses DO NOT

o inject their DNA into the host cell

o reproduce and lyse the host cell immediately

o become dominant and divide with the cell's DNA

o infect a host cell

27. True or false. Some viruses can be prevented with vaccines.

- True False

28. What kind of cell does HIV affect?

- B cells
- White blood cells
- T cells
- Red blood cells

29. One characteristic shared by viruses and cells is

- they both contain nucleic acids
- they both have a crystalline structure
- they gain energy from the sun directly
- they are living organisms

30. Which of the following is not a form of passive transport?

a. osmosis
b. diffusion
c. endocytosis
d. facillitated diffusion

APPENDIX C

PRE-TREATMENT SURVEY

Pre-Treatment Survey

Student Survey (Pre-treatment) *Please circle your response to the following statements and add*

comments if you wish. Participation is voluntary, and you can choose to not answer any question

that you do not want to answer, and you can stop at any time. Your participation or non-

participation will not affect your grade or class standing in any way. All responses will be kept

anonymous.

Name *(optional*) _____ Period _____

1. I participate often in biology.

   Strongly agree agree undecided disagree strongly disagree

   Comments: _____
   _____
2. I feel confident in my ability to do well in biology.

   strongly agree agree undecided disagree strongly disagree

   Comments: _____
   _____
3. Daily quizzes motivate me to study and understand concepts taught.

   strongly agree agree undecided disagree strongly disagree

   Comments: _____
   _____
4. I understand the concepts on a biology quiz or test very well before I take it.

   strongly agree agree undecided disagree strongly disagree

   Comments: _____
   _____
5. Daily quizzes help me to prepare for my tests.

strongly agree agree undecided disagree strongly disagree

Comments: _____
_____

6. I prefer taking daily short quizzes covering less information and it is fresh in my mind
strongly agree agree undecided disagree strongly disagree

Comments: _____
_____

7. I feel confident in my understanding of a topic before taking a quiz or test
strongly agree agree undecided disagree strongly disagree

Comments: _____
_____

8. How I perform on a test is a good indicator of what I know.
strongly agree agree undecided disagree strongly disagree

Comments: _____
_____

9. Name two or three ways you typically prepare for quizzes and tests:

10. Name two or three learning activities that would help you prepare for quizzes and tests:

11. What other questions and comments do you have?

APPENDIX D

MID-TREATMENT SURVEY

Mid-Treatment Survey

Student Survey (Mid-treatment)
Please complete this survey to the best of your ability. Your participation is voluntary, and your
participation or non-participation will not affect your grade or class standing in any way. All
responses will be kept anonymous.

Name *(optional*) _____ Period _____

9. I participate often in biology.

   Strongly agree agree undecided disagree strongly disagree

   Please explain: _____

   _____

10. I feel confident in my ability to do well in biology.

    strongly agree agree undecided disagree strongly disagree

    Comments: _____

    _____

11. Daily quizzes motivate me to study and understand concepts taught.

    strongly agree agree undecided disagree strongly disagree

    Why or why not? _____

    _____

12. I understand the concepts on a biology quiz or test very well before I take it.

    strongly agree agree undecided disagree strongly disagree

    Comments: _____

    _____

13. Daily quizzes help me to prepare for my tests.

    strongly agree agree undecided disagree strongly disagree

Please explain your choice._____

_____

14. I prefer taking daily short quizzes covering less information while it is fresh in my mind
strongly agree agree undecided disagree strongly disagree

Comments: _____

_____

15. I feel confident in my understanding of a topic before taking a quiz or test
strongly agree agree undecided disagree strongly disagree

Comments: _____

_____

16. How I perform on a test is a good indicator of what I know.
strongly agree agree undecided disagree strongly disagree

Please explain: _____

_____

9. Name/describe two or three ways you typically prepare for quizzes and tests:

10. Name/state two or three learning activities that would help you prepare for quizzes and tests:

11. Do you feel the daily quizzes are helping to improve your content knowledge? Why or Why
not?

12. Do you have any additional comments or suggestions for me at this time?

APPENDIX E

POST-TREATMENT SURVEY

Post-Treatment Survey

Student Survey (Post-treatment)

Please complete this survey to the best of your ability. Your participation is voluntary, and your

participation or non-participation will not affect your grade or class standing in any way. All

responses will be kept anonymous.

Name _____

1. I like biology.

   Strongly agree agree undecided disagree strongly disagree

   Please explain: _____

   _____

2. I feel confident in my ability to do well in biology.

   strongly agree agree undecided disagree strongly disagree

   Comments: _____

   _____

3. Daily quizzes motivate me to study and understand concepts taught.

   strongly agree agree undecided disagree strongly disagree

   Why or why not? _____

   _____

4. I understand the concepts taught and feel confident about a topic in biology before taking a quiz or test

   strongly agree agree undecided disagree strongly disagree

Comments: _____

_____

5. Daily quizzes help me to prepare for my tests.

strongly agree agree undecided disagree strongly disagree

Please explain your choice._____

_____

6. I prefer taking daily short quizzes covering less information while it is fresh in my mind

strongly agree agree undecided disagree strongly disagree

Comments: _____

_____

7. How I perform on a test is a good indicator of what I know.

strongly agree agree undecided disagree strongly disagree

Please explain: _____

_____

8. Name/describe two or three ways you typically prepare for quizzes and tests:

9. Name/state two or three learning activities that would help you prepare for quizzes and tests:

10. Do you feel the daily quizzes are helping to improve your content knowledge? Why or Why

not?

11. Which was the hardest/easiest question? Why

12. Do you have any additional comments or suggestions for me at this time?

APPENDIX F

IRB EXEMPTION APPLICATION

REQUEST FOR EXEMPTION

MONTANA STATE UNIVERSITY
Request for Designation of Research as Exempt
MSSE Research Projects Only
(10/14/11)

****
THIS AREA IS FOR INSTITUTIONAL REVIEW BOARD USE ONLY. DO NOT WRITE IN THIS AREA.

Confirmation Date:
Application Number:
****

DATE of SUBMISSION: October 2, 2014

Address each section – do not leave any section blank.

I. INVESTIGATOR:

Name: Chrispus Mwapea
Home or School Mailing Address: 9109 Fondren Road #1803, Houston, TX 77074
Telephone Number: 281 777 5411
E-Mail Address: mlambocm@gmail.com
DATE TRAINING COMPLETED: __02/15/2014__ *[Required training: CITI training; see website for link]*

Investigator Signature _Chrispus Mwapea_____

Name of Project Advisor: Walter Woolbaugh
E-Mail Address of Project Advisor: walter@montana.com

II. TITLE OF RESEARCH PROJECT: THE EFFECT OF DAILY QUIZZES ON STUDENT PERFORMANCE IN END OF COURSE EXAMS

III. BRIEF DESCRIPTION OF RESEARCH METHODS (If using a survey/questionnaire, provide a copy).

I will be looking at the effect of daily quizzes on student performance in end of course exams, and what effect daily quizzes have on students' attitude, motivation and retention of concepts. Please see attached a copy of data collection instruments.

IV. RISKS AND INCONVENIENCES TO SUBJECTS **(do not answer 'None')**:

V. SUBJECTS:

A. Expected numbers of subjects: __63_____

B. Will research involve minors (age <18 years)? **Yes** No
(If 'Yes', please specify and justify.) This will be in a 9th grade classroom with students ages 14 and 15 years old.

C. Will research involve prisoners? Yes **No**

D. Will research involve any specific ethnic, racial, religious, etc. groups of people?
(If 'Yes', please specify and justify.) Yes **No**

VI. FOR RESEARCH INVOLVING SURVEYS OR QUESTIONNAIRES:
(Be sure to indicate on each instrument, survey or questionnaire that participation is voluntary.)

A. Is information being collected about:

Sexual behavior?	Yes	**No**
Criminal behavior?	Yes	**No**
Alcohol or substance abuse?	Yes	**No**
Matters affecting employment?	Yes	**No**
Matters relating to civil litigation?	Yes	**No**

B. Will the information obtained be completely anonymous, with no identifying information linked to the responding subjects? **Yes** No

C. If identifying information will be linked to the responding subjects, how will the subjects be identified? (Please circle or bold your answers)

By name	Yes	No
By code	Yes	No
By other identifying information	Yes	No

D. Does this survey utilize a standardized and/or validated survey tool/questionnaire? **(If yes, see IRB website for <u>required wording</u> on surveys and questionnaires.)** Yes **No**

VII. FOR RESEARCH BEING CONDUCTED IN A CLASSROOM SETTING INVOLVING NORMAL EDUCATIONAL PRACTICES:

A. This research project must be approved by your Principal or School Administrator, unless there are circumstances or policies that do not make this possible. **Provide a copy of the principal's signed approval.** If such approval is not possible, please explain.

B. **Participation of your students in research must be voluntary** and can never affect their rights. Please make this issue clear on all of your research surveys (use introductory text, see below) and/or interviews (use introductory verbal statement, see below). The following wording or something similar can be used for the introductory text or statement: **Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way.**

C. Extra credit should not be used to encourage participation. If you absolutely need to use extra credit, then an alternative activity involving the same amount of time and effort must be provided for those who choose not to participate. This must be clearly described in your IRB application.

E. Depending on your school policies, **consent forms may or may not be required for your research.** Please indicate whether you will be using consent forms or not. If you are not using consent forms, please justify (e.g., school policy, etc.). **If you do use consent forms, you must include signature lines for parental consent AND student assent.** (Please use accepted format from our website and provide a stand-alone copy. Do not include form here.) **I am sending both forms as a separate attachment.**

APPENDIX G

IRB EXEMPTION APPROVAL LETTER

MONTANA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
FWA 00000165

960 Technology Blvd. Room 127
c/o Immunology & Infectious Diseases
Montana State University
Bozeman, MT 59718
Telephone: 406-994-6783
FAX: 406-994-4303
E-mail: cherylj@montana.edu

Chair: Mark Quinn
406-994-5721
mquinn@montana.edu
Administrator:
Cheryl Johnson
406-994-6783
cherylj@montana.edu

MEMORANDUM

TO: Chrispus Mwapea and Walt Woolbaugh

FROM: Mark Quinn, Chair Mark Quinn CTJ

DATE: October 3, 2014

RE: *"The Effect of Daily Quizzes on Student Performance in End of Course Exams"* [CM100314-EX]

The above research, described in your submission of October 3, 2014, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

X (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

X (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX H

PRE-TREATMENT, MID-TREATMENT AND POST-TREATMENT SURVEY ANALYSIS

Pre-Treatment, Mid-Treatment and Post-Treatment Survey Analysis

Pre-Treatment Survey Analysis (N = 62)

Qn #	SA	A	U	D	SD	Sum	Avr Score
1	25	124	60	10	0	219	3.6
2	65	120	51	2	1	239	3.9
3	65	124	27	16	1	233	3.8
4	30	156	39	8	0	233	3.8
5	110	104	33	8	0	255	4
6	70	112	42	14	0	238	3.8
7	20	144	51	8	0	223	3.7
8	90	152	15	2	0	259	4.2

Mid-Treatment Survey Analysis (N = 58)

Qn #	SA	A	U	D	SD	Sum	Avr Score
1	25	120	51	8	0	205	3.7
2	30	140	33	10	0	215	3.8
3	55	112	48	6	0	224	3.9
4	10	140	57	6	0	217	3.7
5	75	144	12	6	0	242	4.2
6	50	148	27	4	0	235	4.1
7	15	108	69	10	0	209	3.6
8	65	140	21	2	1	237	4.2

Post-Treatment Survey

	Frequency of Responses, N = 61						
Qn #	SA	A	U	D	SD	Sum	Avr. Score
1	9	37	11	4	0	234	3.8
2	7	38	12	4	0	231	3.8
3	7	38	12	3	1	227	3.7
4	3	37	18	3	0	220	3.6
5	12	41	7	1	0	247	4
6	11	39	10	1	0	243	4
7							
8	9	36	11	4	1	231	3.8