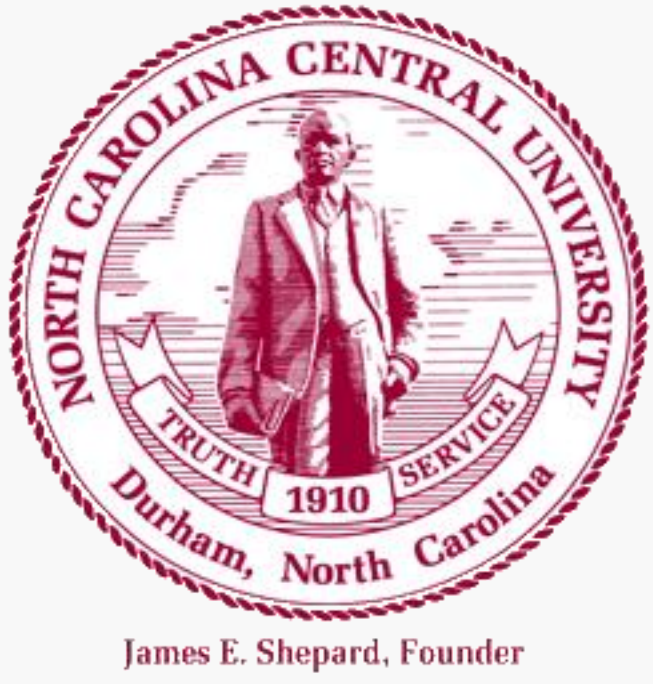


The Use of Daily Quizzes in an Introductory Biology Course For Majors

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ABSTRACT

One of the most difficult teaching challenges, especially in introductory science courses, is encouraging students to study on a regular basis. There is an expectation in higher education that students should study 1-2 hours each day for each hour in class. Even though students acknowledge this expectation, many do not put this into practice. There are many assumptions as to why students do not continuously study: jobs, extra-curricular activities, and lack of motivation. In regard to this problem, an obvious question a professor can ask is "How can I encourage students to study on a continual basis?" The faculty in the present study investigated if the implementation of short daily in-class quizzes in an introductory general biology course for majors would encourage students to study on a continual basis and increase their course performance. The quizzes would cover the content discussed in the previous class meeting and compose 10% of the final course grade. It is hypothesized that the daily quizzes will encourage students to study on a continual basis, resulting in an overall improvement in exam grades and final course grades. The participants for this study were enrolled in one of four sections of General Biology I. Two of the sections received the daily quizzes, while the other two sections did not. All other course material (exams, laboratory exercises, homework) was exactly the same. Quantitative and qualitative data were collected through the administration of pre- and post-tests to measure student learning gains, post-exam surveys, the collection of weekly study logs, and analysis of both exam and final grade performance. Results indicate that there was no difference between the experimental (pre-test mean 50.7 ± 15.5 ; post-test mean 75.7 ± 15.9) and control groups (pre-test mean 47.8 ± 13.9 ; post-test mean 76.0 ± 13.5) in learning gains (pre-test $t = -0.854$, $p = 0.396$; post-test $t = 1439.5$, $p = 0.811$) and time spent studying per week. There was a higher percentage of students in the experimental group who received an A or B on the four lecture exams as well as their final course grade. Therefore, one can conclude that daily quizzes did not encourage students to study on a continual basis, but did have had an impact on exam and course performance.

INTRODUCTION

As educators, one of the most important goals of our teaching is to increase student learning and overall course performance. Equally important to science students is the goal of obtaining a grade that will advance their academic and professional career (Soto and Anand, 2009). Figure 1 shows the Average SAT scores of First-Time Freshmen at North Carolina Central University (NCCU) from Fall 2005 through Fall 2009. The Total SAT ranged from 842 (Fall 2007) to 861 (Fall 2005). The SAT Math scores ranged from 423 (Fall 2007) to 434 (Fall 2006). The SAT Verbal scores ranged from 419 (Fall 2007) to 429 (Fall 2005). This data indicates that the ability of First-Time Freshmen enrolled at our institution did not change over the years addressed in this study.

Since Fall 2005, less than fifty percent of the students completing General Biology I (BIOL 1101) at NCCU have received a final course grade of "C" or better (Figure 2). BIOL 1101 is the first core course for biology majors, other science majors, and those students who will be taking upper-level courses in biology. In our opinion, one of the most difficult teaching challenges of faculty who teach introductory science classes is encouraging students to study on a regular basis. During the first week of classes, the students are told that there is an expectation in higher education that students should study 1-2 hours each day for each hour in class. Even though they nod their heads as if they have heard it before, many students simply don't put this to practice. There are many assumptions one can make as to why students do not study for their classes on a continual basis. These could include working, participating in extracurricular activities, struggling with time-management, etc. In regard to this problem, we asked ourselves "What can be done to encourage our students to study on a continual basis?" To follow up on this, another question we asked was "If our students study on a continual basis, will there be an increase in class performance on exams and essentially, final course performance?"

Over the past 5 years, students enrolled in BIOL 1101 have been given homework assignments based on chapter objectives in hopes that this would encourage them to study and consequently earn a high grade in the class. However, we realized that students were simply writing an answer from the textbook or lecture notes without any comprehension of the questions being asked. Therefore, this study investigated if daily quizzes would motivate students to study on a continual basis and lead to an increase in overall course performance. Many investigators of various disciplines have administered quizzes to encourage reading, to encourage attendance, to enhance student confidence on exams, etc. (Azorlosa and Renner, 2006; Dobson, 2008; Haberyan, 2003; Haigh, 2007; Johnson and Kiviniemi, 2009; Narloch et al., 2006). We have yet to find anyone who has addressed this problem in a freshmen-level Biology majors course in order to encourage students to keep pace with the course material.

In addition to the daily quizzes, quantitative and qualitative data were collected through the collection of weekly study logs, the administration of pre- and post-tests to measure student learning gains, and analysis of both exam and final grade performance.

FIGURE 1.

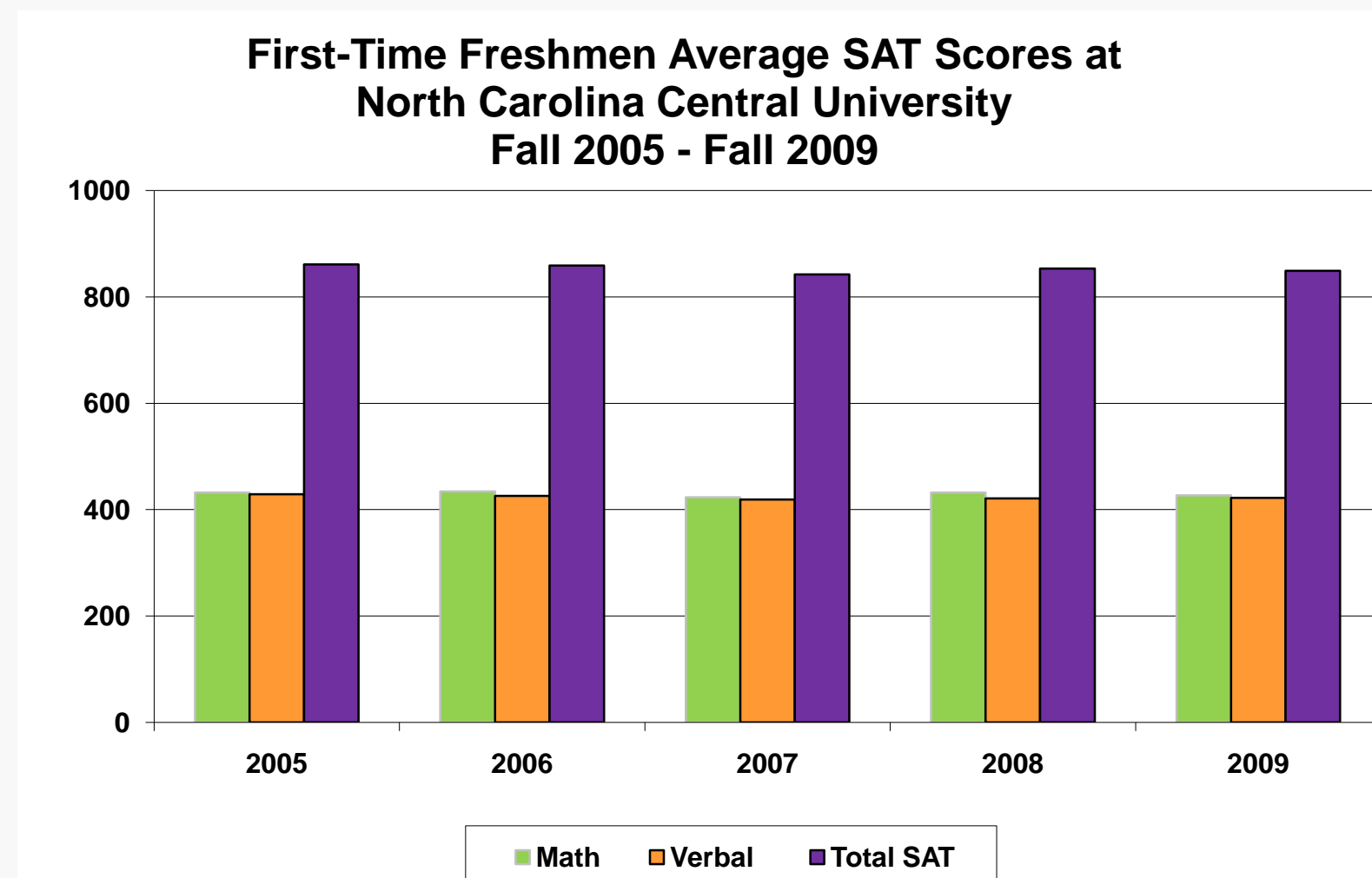
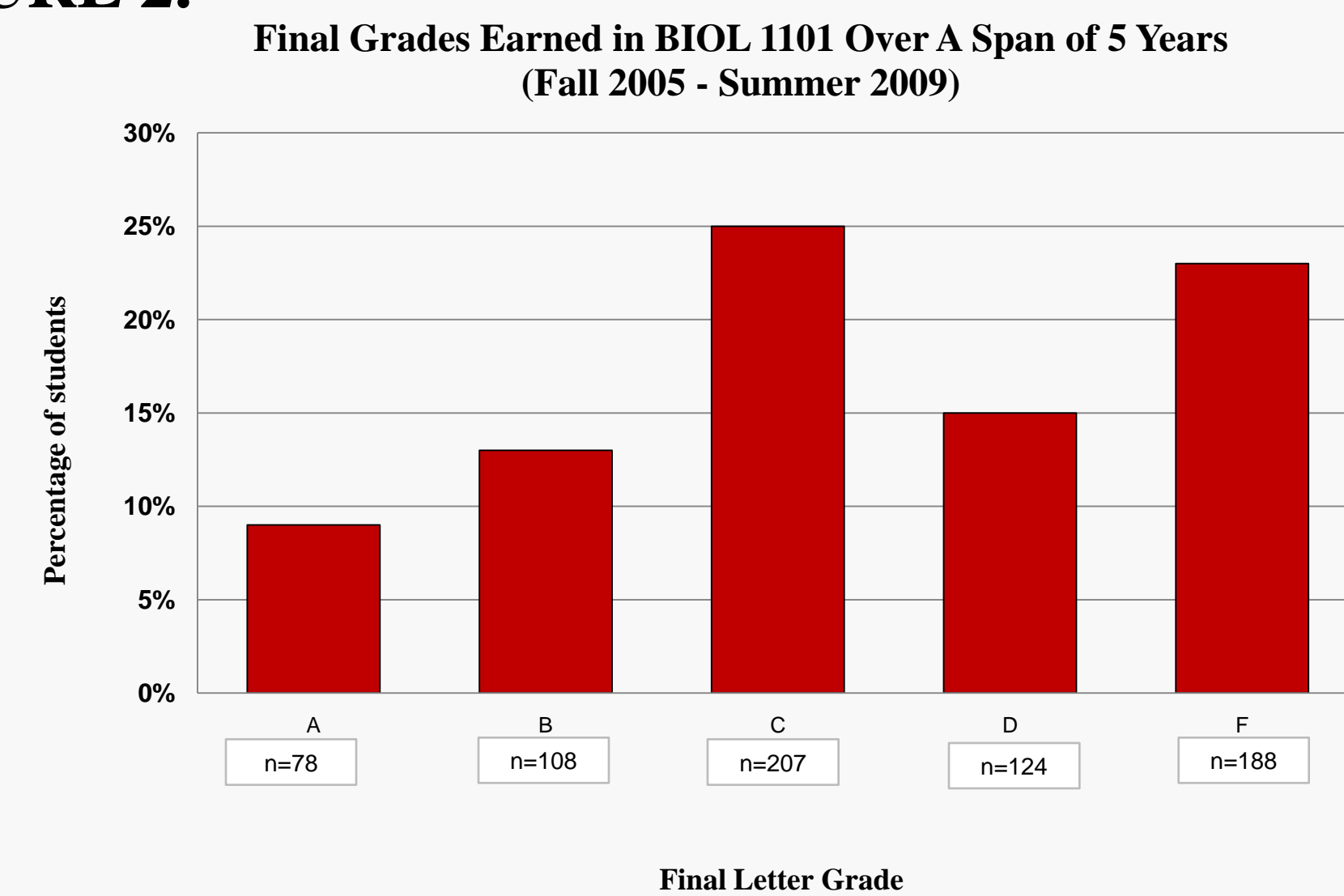


FIGURE 2.



METHODS

Introductory Biology Course for Majors at NCCU

- Students chosen to participate in this study were enrolled in General Biology I (BIOL 1101).
- The content of this course includes an introduction to the scientific method, a brief survey of the history of biology, an introduction to the physical and chemical properties of biological molecules, a survey of cellular structure and function, and an introduction to the basic principles of genetics.
- This class meets for 3 lecture hours and 2 laboratory hours per week.

Participants

- Student participants were enrolled in one of four (4) sections of BIOL 1101 taught by one of two Assistant Professors
 - 99 student participants (23-26 students per section).
 - Participation in this study was not required for course credit.
 - This research study (IRB approval number 1200892) was exempted and cleared for implementation by the NCCU Institutional Review Board (IRB) for the Protection of Human Subjects in Research.

Data Collected

- Daily Quizzes**
 - Composed of 4-5 questions drawn from the material discussed in the previous class meeting (Figure 3).
 - Questions were of similar format to exam questions (i.e. multiple choice, true/false, short answer).
 - These quizzes, in addition to homework and in-class assignments, composed 10% of their final course grade.
 - Students enrolled in BIOL 1101-01 and BIOL 1101-02 did not receive daily quizzes (control group), while students enrolled in BIOL 1101-03 and BIOL 1101-04 received daily quizzes (experimental group). All other course material (textbook, homework, labs, exams) were exactly the same.
- Study Logs**
 - For each week of the semester, students recorded their block(s) of study time, a description of their study activities, and total time spent studying.
 - Placed in a designated box in the assigned classrooms every Monday class period.
- Pre-test and Post-test**
 - A forty question pre-test was administered to the students in all sections of BIOL 1101 during the first week of classes.
 - All questions were multiple-choice.
 - The same forty questions were incorporated into the final exam as post-test.
- Final Grades**
 - Final grades were calculated based on lecture exams (40%), quizzes & assignments (10%), lab participation (15%), lab exams (20%), and comprehensive final exam (15%).
 - Final grades were obtained from our University Course Enrollment System (BANNER) from Fall 2005 to Fall 2009.

FIGURE 3.

- Daily Quiz #2**
- List, in order, the 4 steps of the scientific method.
 - Which of the following statements is a hypothesis?
 - Will increasing my cat's food increase her weight?
 - Increasing my cat's food consumption will result in a 20% increase in her weight.
 - I will feed my cat more food.
 - My cat has gained weight, therefore she is eating more food.
 - Biologists are doing a study on a athletes' intake of steroids. Which one of the following statements would be the experimental (independent) variable and which one would be the responding (dependent) variable?
 - Average gain in the body weight of a group of athletes
 - Intake of anabolic steroids by an athlete
 - Name one scientific theory.

RESULTS

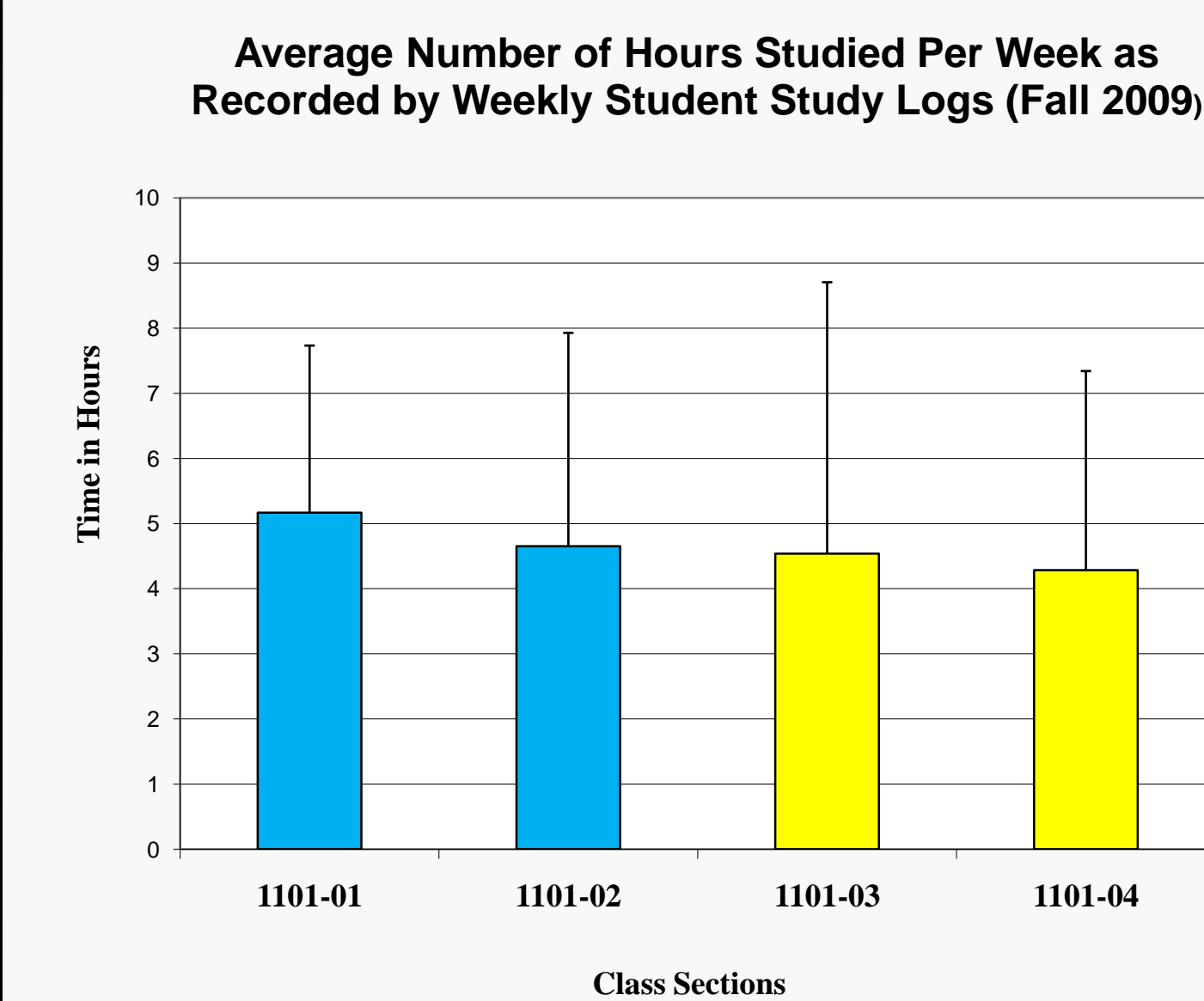
- There was no significant difference between the experimental (pre-test mean 50.7 ± 15.5 ; post-test mean 75.7 ± 15.9) and control groups (pre-test mean 47.8 ± 13.9 ; post-test mean 76.0 ± 13.5) in learning gains (pre-test $t = -0.854$, $p = 0.396$; post-test $t = 1439.5$, $p = 0.811$); Table 1.
- We collected Study Logs from the students each week to assess both time spent studying and type of study activity. Our data revealed that those students in the experimental group who received daily quizzes on average studied slightly less hours per week (mean 4.4 ± 3.6) than those students who were in the control group and did not receive daily quizzes (mean 4.9 ± 2.9 ; Figure 4). The study activities were the same between the two groups of students.
- In comparing the Fall 2009 final course grades in BIOL 1101 between those sections without daily quizzes (control group) to those sections with daily quizzes (experimental group), there was a higher percentage of students in the experimental group who received an A or B on the four lecture exams and the final exam (Table 2).
- In comparing the Fall 2009 final course grades in BIOL 1101 between those sections without daily quizzes (control group) to those sections with daily quizzes (experimental group), there was a higher percentage of students in the experimental group who received a final course grade of an A or B (Figure 5).

TABLE 1.

Comparison of the Mean Percentage Scores of Pre-test and Post-test

	Pre-test	Post-test
No quiz sections	47.8 ± 13.9	76 ± 13.5
Quiz sections	50.7 ± 15.5	75.7 ± 15.9

FIGURE 4.



Examples of Study Activities

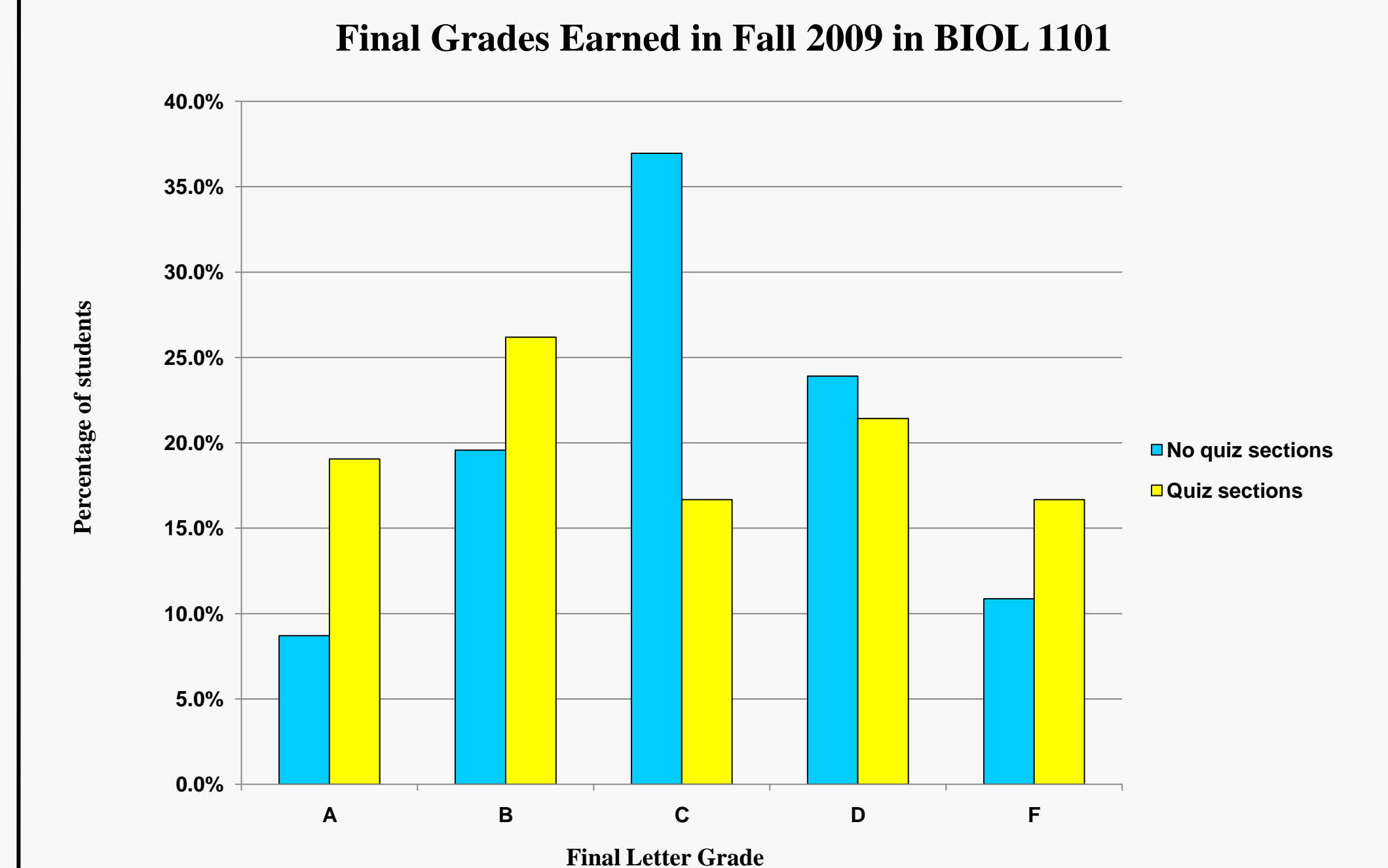
- Reading the textbook
- Reviewed learning objectives
- Reviewing class notes
- Making flash cards
- Studying with a classmate

TABLE 2.

% of students receiving specific letter grade

EXAM	A	B	C	D	F
EXAM 1					
No quiz sections	14.6	16.7	14.6	22.9	31.3
Quiz sections	17.8	24.4	8.9	20	28.9
EXAM 2					
No quiz sections	4.8	19	33.3	21.4	21.4
Quiz sections	14.3	16.7	28.6	16.7	23.8
EXAM 3					
No quiz sections	15.9	18.2	20.5	27.3	18.2
Quiz sections	21.4	18.2	21.4	26.2	11.9
EXAM 4					
No quiz sections	15.6	17.8	31.1	20	15.6
Quiz sections	20	22.5	17.5	17.5	22.5
FINAL					
No quiz sections	26.1	23.9	23.9	15.2	10.9
Quiz sections	23.8	17	19.5	14.6	24.4

FIGURE 5.



CONCLUSIONS

This study examined if the implementation of an instructional strategy, such as daily quizzes, would encourage students to study on a continual basis and lead to an increase in student achievement.

There was no significant difference between the experimental (mean 4.6 hrs) and control groups (mean 4.9 hrs.) in time spent studying per week. Regardless of the group, in our estimation, this was not nearly enough time to allow students to adequately review the material presented in the previous lecture and complete the assigned readings for the upcoming lecture and/or laboratory sessions. Soto and Anand (2009) reported that their students expressed a change in attitude regarding expected and performed study habits in a lower division Cell Biology core course. They suggested that although most students expected to spend a large amount of time studying, their commitments to other courses, outside work, or other personal matters prevented them from doing so. Similar distractions may have prevented our students from dedicating more study time in BIOL 1101.

There was a higher percentage of students in the experimental group who received an A or B on the four lecture exams as well as their final course grade. This supports data by Narloch et al. (2006) who determined that students who received pre-lecture quizzes performed better on exams in comparison to those students who were not quizzed.

Based on this research study, one can conclude that daily quizzes did not encourage students to study on a continual basis, but they did have a positive impact on exam and course performance. This study supports Glenn's (2007) conclusion that the purpose of quizzing is to implant facts in students' memory rather than motivating students to pay attention or study more.

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ACKNOWLEDGEMENTS

Thanks to the following NCCU undergraduate students for their help with the data collection and analysis: Eric Barnes, Naadeyah Haseeb, and Christopher Whitfield.

Thanks to the ASM Biology Scholars Research Residency Program for their continuous support in our pursuit of this research study, especially Team 2: Bill Cliff, Caron Inyoue, Jodie Krontritis-Litowitz, and Jacqueline Washington.