

## Determining the Degree to Which Students Meet the Learned Goal Objectives in Microbiology through the Utilization of Pre and Post Testing Mechanisms

<sup>1</sup>Mohannad G. AL-Saghir, <sup>2</sup>Liesta Walker and <sup>3</sup>Abd Salam Abd Salam

<sup>1</sup>Department of Biological Sciences, Ohio University Zanesville,  
1425 Newark Road, Zanesville, Ohio 43701, USA

<sup>2</sup>Department of Health and Human Services, Ohio University Zanesville,  
1425 Newark Road, Zanesville, Ohio 43701, USA

<sup>3</sup>Department of Statistics, Faculty of Economics and Political Science, Cairo University, Giza, Egypt

**Abstract:** Due to the overwhelming numbers of pre-nursing students that have demonstrated less than adequate academic accomplishment in Microbiology, it became necessary to establish an achievement benchmark. This was done to better determine needed outcomes, reestablish and modify teaching constructs in a concerted effort to decrease attrition rates. The pre-test results showed that students are struggling with Microbiology topics and the post-test results showed the same group of students performance is improving.

**Key words:** Microbiology • Pre-Test • Post-Test • Nursing

### INTRODUCTION

Assessments are by their very nature designed to evaluate learning and knowledge, in this instance the assessment/evaluation exams are utilized to determine student knowledge and acquired educational development over a ten week period. Classroom assessment is the foundation for most college courses. Astin [1] presented three major forms of classroom assessment: course examinations, assessment of course projects (homework) and course grades, stating that some educators think that classroom assessments are capable of facilitating incentives for the student to learn. This ideation promoted the use of the pre-test grades to then promote an internalized incentive for the students in this microbiology course to strive for a greater degree of excellence during the ten week period knowing that there would be a post-test upon course completion.

This work was designed to provide relevant feedback indicative of the level of knowledge possessed by each group of students. The assessment assisted in determining a baseline of student knowledge utilizing a multiple choice testing format [2]. Through a design incorporating test items that increased in cognitive levels

of difficulty and understanding, it was possible to pinpoint exact cut off levels based on student averages in levels of achievement. Consequently, the course could then be redesigned to better deposit greater concentration of knowledge in the areas of lack based on the responses provided by each individual group of incoming students.

### MATERIALS AND METHODS

**The Exam:** This evaluation exam consisted of fifty multiple choice type questions ranging from very basic knowledge type to questions posited to students having extensive knowledge of the subject. These questions were presented to the class and due at the end of the first week of the course. Data was collected for one year and two hundreds students took the exam.

This assessment generated information that could facilitate an informed overview of the incoming students' knowledge and understanding of the material.

Initially students were asked demographic questions such as:

- Are you a transitioning LPN?
- Are you an incoming pre nursing freshman?

**Corresponding author:** Mohannad G. AL-Saghir, Associate Professor of Biological Science, Ohio University Zanesville Elson 251, 1425 Newark Road Zanesville OH 43701.

- Are you currently taking nursing courses?
- Are you retaking this course?

After which they began the exam itself. Below you will find a set of sample questions.

**Sample Test Items:** (Note: this was a multiple choice test and the answers have been excluded).

- The microorganisms that do not have a nucleus in their cells are called.
- All microorganisms are best defined as organisms that.
- Which of the following is not considered a microorganism.
- Spontaneous generation is the belief that.
- The microorganisms that do have a true nucleus in their cells are called.
- Disease-causing microorganisms are called
- In Whittaker's system, there are Blank; and Blank... kingdoms
- Which of the following is a taxon that contains all the other taxa listed
- The most immediate result of destruction of a cell's ribosomes would be
- Protists include

**Data Analysis:** Comparative and statistical analyses using Anderson and Darling [3], Kolmogorov [4] and Shapiro and Wilk [5] tests were conducted. For the student test grades (before and after) our course, the paired t-test has been utilized in order to determine if the difference between pre-test and post test results is significant. To achieve this, firstly our data set is independent. Secondly, the normality has been tested using Proc UNIVARIATE produces in SAS [6].

## RESULTS

**Comparative Analysis:** The data in (Fig. 1) addresses the results of the evaluative methodology utilized to assist in creating a more effective teaching construct. The results showed that there is a significant difference in students (regardless their academic level) performance before and after taking the course.

**Statistical Analysis:** Based on the results from Kolmogorov, Shapiro-Wilk anderson-Darling tests, the data were normally distributed (P-Value > 0.01) (Table 1).

Table 1: Tests for Normality for students' pre and post-course exam grades

Tests for Normality				
Test	Statistic		p Value	
Shapiro-Wilk	W	0.970009	Pr < W	0.2316
Kolmogorov-Smirnov	D	0.000129	Pr > D	>0.1500
Cramer-von Mises	W-Sq	0.04537	Pr > W-Sq	>0.2500
Anderson-Darling	A-Sq	0.34448	Pr > A-Sq	>0.2500

Table 2: The T-TEST for students' pre and post-course exam grades

### The TTEST Procedure

Difference: before - after

N	Mean	Std Dev	Std Err	Minimum	Maximum
50	-3.1600	4.9088	0.6942	-12.0000	6.0000

Mean	95% CL Mean	Std Dev	95% CL Std Dev
-3.1600	-4.5551 -1.7649	4.9088	4.1005 6.1170

DF	t Value	Pr >  t
49	-4.55	<.0001

The results also showed that there is a significant difference (P-value <0.001) in the student grades form before and after the course (Table 2).

## DISCUSSION

This type of testing is considered criterion referenced testing making it possible to establish absolute standards of performance while also allowing for assessment of the students actual change with time. This methodology, as stated in Astin [1], promotes the value of teaching and learning. By relating test items to course construct and learning it was possible to assess the knowledge the student possessed at the time of taking the pre-test in comparison to their demonstrated knowledge after assessing their post-test scores. Each student then had a set standard of achievement to be evaluated against; not another student but themselves. Thus, the data demonstrated how much each individual student's knowledge changed through time.

This evaluative process was important in that it provided a more accurate account of the individual student and their standard of achievement. The fact that the comparison was indicative of no other outside variable other than the exact same students' scores based on previous knowledge and then upon learned knowledge provided a more true knowledge attainment benchmark [7].

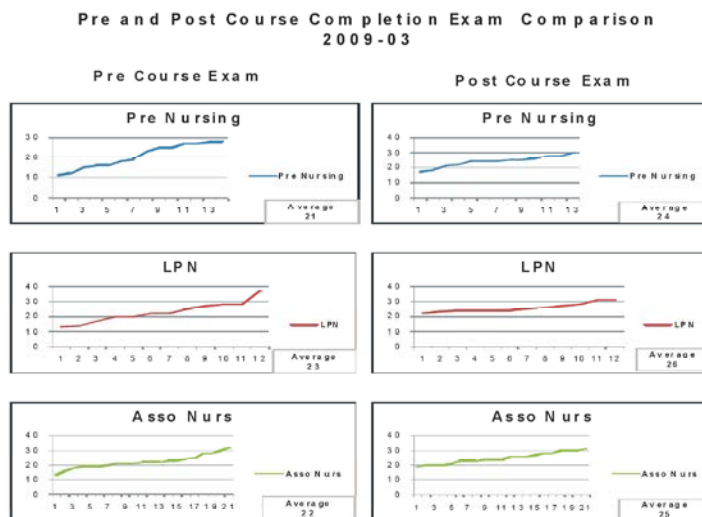


Fig. 1: Pre and Post- Course Completion Exam Comparison. X represents the students' number who took the exam and their academic level; Y represents their grade

**Limitation:** Su *et al.* [8] stated that it is difficult to evaluate the individual learning objectives through the utilization of multiple choice questions. Multiple choice questions do not indicate the thought process by which the student arrives at their answer.

Secondarily, the fact that not all students took the pre-test or the post-test made it necessary to use only those student scores who completed both in the study therein using paired data. Finally, the lack of like research limited the ability to compare other research goal outcomes.

In conclusion, this study was designed for the sole purpose of assessing the instructional viability in one specific course of study. It was not for the purpose of giving grades or to satisfy any external accountability framework. It was utilized for the solitary intention of enhancing student learning and providing greater academic instruction through focused learning opportunities.

#### AKNOWLEDGEMENTS

The authors are grateful to Ohio University Zanesville for supporting and funding this project. We would like to thank Rhonda Moore for her contribution of charts and other graphics.

#### REFERENCES

1. Astin, A.W., 1991. Assessment for excellence; the philosophy and practice of assessment and evaluation in higher education. New York NY: Macmillan Publishing.
2. Shepard, L.A., 2000. The role of assessment in a learning culture. *Educational Researcher*, 29(7): 4-14.
3. Anderson, T.W. and D.A. Darling, 1954. A Test of Goodness of Fit. *Journal of the American Statistical Association*, 49: 765-769.
4. Kolmogorov, A.N., 1933. Sulla determinazione empirica di una legge di distribuzione, *Giornale dell' Istituto Italiano degli Attuari*, 4: 83-91. (6.1).
5. Shapiro, S.S. and M.B. Wilk, 1965. An Analysis of Variance Test for Normality (Complete Samples). *Biometrika*, 52(3/4): 591-611.
6. SAS (Statistical and Data Analysis) Institute, 2003. JMP: A Guide to Statistical and Data Analysis, Version 5.0.1. SAS Institute, Cary, NC.
7. Scouler, K., 1998. The influence of assessment method on student's learning approached: Multiple choice question examination versus assignment essay. *Higher Education*, 35: 453-472.
8. Su, W.M., P.J. Osisek, C. Montgomery and S. Pellar, 2009. Designing multiple-choice test items at higher cognitive levels. *Nursing Education*, 34: 223-227.