Admissions Criteria as Predictors of CLS Student Success

ABSTRACT

A passing score on the American Society for Clinical Pathology (ASCP) Board of Certification (BOC) exam is a metric of a students' academic success in most Clinical Laboratory Science/Medical Laboratory Science (CLS/MLS) programs. It would be ideal if CLS/MLS programs are able to predict a student's success when an individual applies for admission to a CLS/MLS program. This study aimed to demonstrate that there is a positive correlation between admissions scores at the Texas Tech University Health Science Center (TTUHSC) School of Health Professions (SHP) and students' performance on the BOC exam. Using simple linear regression analysis with Pearson correlation, specific criteria that are part of the application and admissions scoring process were used to determine the relationship. The results of the study indicated moderate positive correlation between certain of these criteria and BOC exam performance, but they provide enough information to make an admissions decision on students who would have the best chance of success in the TTUHSC CLS program and the profession.

ABBREVIATIONS: ASCP – American Society for Clinical Pathology; BOC – Board of Certification; CLS - Clinical Laboratory Science; GPA – grade point average; MLS – Medical Laboratory Science; TTUHSC – Texas Tech University Health Sciences Center; TAS – Total Admissions Score

INDEX TERMS: Clinical Laboratory Science, Admissions Criteria, Board of Certification, Education

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INTRODUCTION

Since 1985, the Department of Laboratory Sciences and Primary Care at Texas Tech University Health Science Center has offered a traditional face-to-face in-classroom two-year Bachelor of Science curriculum in CLS. The traditional CLS program at TTUHSC has had an average class size of twenty to thirty students per admissions cycle. In the fall of 2008, TTUHSC began to offer an online one year Bachelor of Science CLS degree program and a one year certificate program was added the following year. The online CLS program enrollment averages approximately 50 to 60 students per cycle. Student enrollment in the traditional program typically consists of a younger group of men and women beginning their junior year in college, while the online students comprise a more diverse group of men and women of various ages from different educational and employment backgrounds. These students enter a rigorous twelve-month program that includes two weeks of hands-on laboratory training on-site at the TTUHSC campus and a twelve-week preceptorship at an accredited clinical site.

In any professional academic program, the admission process is designed to select applicants of the highest caliber to ensure student academic success in that program. Professional programs that include health professions programs, law schools, and dental schools, use scores obtained on post-graduation certification or licensing exams to indicate student academic achievement within that program. For a Clinical Laboratory Science educational program, one key metric of success is student performance on the ASCP BOC examination.

The purpose of this study was to determine if there is a positive correlation between certain components of TTUHSC CLS student applicants' admissions assessment and their ASCP BOC exam overall score after completing the program. This study examined the correlation between several elements of the admissions evaluation process, including science grade point average (GPA), non-science prerequisite GPA, the interview score, and the total admissions score with post-graduation BOC exam scores.

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Whether a CLS academic program is traditional, online, or hybrid, high pass rates on the BOC exam are the goal of most laboratory science programs as these scores are indicative of students' mastery of the curriculum. However, how or whether a program can predict if a student will pass the BOC exam remains a question. Many of the applicants to the TTUHSC CLS online programs seek admission to advance from a medical laboratory technician to a medical laboratory scientist while others with a degree in biology or biochemistry simply look to put their skills to effective use. Undergraduates in the traditional program pursue this direction in their desire to be involved in healthcare or to find something that will provide them with gainful employment in an area they enjoy. Student goals following graduation vary, but each CLS student's goal before that event is to attain a degree or certificate from the CLS program and pass the ASCP BOC exam. Because the diverse applicant pool is large, the TTUHSC CLS programs looked for a way to predict student outcome based on information obtained during a student's application and admission's office review. Since passing the BOC exam is a metric of student academic success, TTUHSC devised a correlation study with the hypothesis that certain parts of the application and admissions evaluation (the independent variables) will positively correlate with a passing score on the BOC exam (the dependent variable).

Similar studies of admission criteria and student success have been performed with other health-related professional programs. While it is recognized that some of these studies come from different health-related programs and are based on the achievement of different competency skills, the comparison of their admission criteria to students' passing of their proficiency exams revealed some important associations to this study. In a study of the Doctor of Veterinary Medicine (1) and Doctorate of Physical Therapy program admissions criteria and post-graduation competency, studies reported low correlations between admissions criteria and outcomes on licensing exams and indicated a need to reevaluate admission criteria as predictors of school success (2,3). In a national study of Physical Therapy students scheduled to graduate in the years 2000 through 2004 from 20 programs, Utzman et.al.'s (3) study provided an in-depth statistical analysis of admission criteria correlated to the National

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Physical Therapy Exam results and found that the strongest correlation existed between poor verbal GRE scores and exam failure. However, a study of a dental school admission criteria, reported a strong correlation with overall school performance (in which admissions criteria were included) and licensing exam results. This study indicated that the best predictor of success was students' performance during their enrollment in the program of study (4). Conway-Klaassen (5) reported recent studies of an MLS program's admission selection criteria compared with post-graduation achievement as measure by passing scores on the ASCP BOC exam. This retrospective analysis demonstrated moderately positive and significant correlations between cumulative GPA, science GPA and prerequisite GPA and performance on the BOC exam. Another recent study authored by Alaki et.al. and published in 2016 (6) regarded undergraduate pre-dental school applicants and their interview scores, motives, and ambitions. These authors reported that those aspects of the dental school application were significant positive predictors of student GPA and concluded that the interview score was predictive of future academic performance. The purpose of this study was to determine if there is a positive correlation between certain components of TTUHSC CLS student applicants' admissions assessment and their ASCP BOC exam overall score after completing the program. This study examined the correlation between several elements of the admissions evaluation process, including science grade point average (GPA), nonscience prerequisite GPA, the interview score, and the total admissions score with post-graduation BOC exam scores. Hopefully, results would indicate which component of the overall admissions score would serve as a reliable predictor of the student's success in the program.

MATERIALS AND METHODS

The TTUHSC traditional face-to-face classroom CLS program's admissions data from 2010 to 2014 (n = 115) and the TTUHSC online (post-baccalaureate and certificate) CLS program's admissions from 2011 to 2014 (n = 117) data was used for this study. For each of these years, students' post-graduation ASCP BOC exam scores (n=117; the dependent variable) were recorded. Admissions data used as independent variables included the components of the Academic Score (student's science GPA,

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non-science prerequisite GPA, and essay score) and the Student Interview Score. Using simple linear regression and Pearson correlation, data from both traditional and online programs were analyzed to determine if a positive correlation existed between TTUHSC CLS program's admissions criteria with the national certification exam scores. Institutional review board approval was not required for this study.

Admission Process:

Each year in early spring, the SHP Office of Admissions and Student Affairs opens the admissions process to select students that will enter the program in the fall semester of the same year. The SHP Office of Admissions and Student Affairs collects and collates all the applications for each of the CLS programs. This Office reviews and evaluates applications for completeness to ensure that all required prerequisites courses are completed with a minimum grade of "C" or higher. Applications include a completed application form, up-to-date official transcripts showing all courses taken from all colleges attended, and the applicant's written essay. Once assessment for completeness of the applicant's folder is done, it is sent to the TTUHSC Department of Laboratory Science and Primary Care CLS Admission's Committee to review for admission. ~~All admission data for this study was taken from the TTUHSC SHP Office of Admissions and Student Affairs Admission Report~~. Students with the highest Total Admission Scores (TAS) are granted admission to the CLS programs.

Admissions Criteria and Admission Score:

The Total Admission Score (TAS) is a composite score that represents the two major admissions criteria: academic performance and student interview skills. The TAS consists of the sum of the Academic Score and the Student Interview score worth 50 points each. The Academic Score is a composite of the student's science GPA, non-science prerequisite GPA, and the student's essay score. The science GPA is ranked on a scale of 6 to 20 possible points (6 points being a GPA of 2.5 and 20 points for a GPA of 4.0). The student's non-science prerequisite GPA is ranked on a scale of 6 to 15 possible points (6 points being a GPA of 2.5 and 15 points for a GPA of 4.0). The student's essay is

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worth 15 points which are achieved if the essay is well-written using correct grammar and spelling, reflects an understanding of the profession, and contains clearly stated personal goals. See Figure 1 for Academic Score Sheet. All applicants with higher than average Academic Scores will be invited for an interview with two of the program's faculty. The remaining fifty points of the TAS is assessed from the applicant's interview score. Each applicant is asked a standardized set of questions in the areas of study habits and past academic preparation, motivation and interest in the profession, general knowledge about the profession, personal communication and background, and also includes the interviewer's personal observations. The TAS from each student application is assessed and ranked on a 100-point scale.

Statistical Analysis:

Simple linear regression analysis and Pearson correlation studies to determine coefficients of correlation and determination were performed to assess correlation and significance between components of the TAS and the ASCP BOC exam scores of students in the TTUHSC CLS programs. The Graphpad InStat3© program was used to obtain results. The dependent variable was the BOC exam score and the independent variables that were correlated to the exam score included the TAS, science GPA, non-science prerequisite GPA, and the Academic Score. The strength (fair, moderate, good or excellent) of the correlations was assessed using the basic tenets for evaluating correlation coefficients (7,8) in which a correlation ranging from 0.00 to 0.25 indicate little or no relationship; those from 0.25 to 0.5 suggest a fair degree of relationship; values of 0.50 to 0.75 are moderate to good; and values above 0.75 are considered good to excellent. Significance indicated how different the regression line was from a line having no slope (flat). Scatterplots were prepared to illustrate these results. Coefficients of determination indicated what percentage of the BOC exam scores could be attributed to the independent variables.

RESULTS

Results of the statistical analyses of the study are summarized in Table 1; scatterplots are shown in Figure 2a-h. The TAS of the traditional classroom students demonstrated a fair positive and significant (p = 0.005) correlation with an r value of 0.321 compared to that of the students in the online programs (p = 0.009; r = 0.239). The association of science GPA and BOC exam scores showed significant moderate and positive correlation. In this case, the traditional CLS students' and the online students' science GPAs produced correlation coefficient values equal to 0.329 and 0.261, respectively. When correlated to the BOC exam scores, non-science prerequisite GPA of the traditional classroom students achieved significance (p=0.001) with an r value of 0.381 indicating a fair positive correlation between these two measures. The r value of the online students' non-science prerequisite GPA compared to the BOC exam score was equal to 0.250, also indicating significance (p=0.007) with a weak positive correlation. Correlation of the Academic Scores (science GPA, non-science prerequisite GPA, and the essay score) to the BOC exam score produced an r equal to 0.266 (fair correlation) for the online students but only an r equal to 0.102 for the traditional students. Coefficients of determination (r^2), although low in each case, were above 10% for all of the traditional students' BOC exam correlations, with the non-science prerequisite GPA being highest (14.5%).

DISCUSSION

Findings of this study <mark>support</mark> the hypothesis that criteria in the application and admissions evaluation (the independent variables) positively correlate with a passing score on the BOC exam (the dependent variable). While it is understood that correlation does not infer causation, the results indicate that there is a positive relationship between the independent and dependent variables and that the relationships <mark>are</mark> fair to moderate. It is the goal of the TTUHSC CLS programs to generate students who will go on to become successful laboratorians, researchers or other healthcare professionals. With this in mind, the TTHUHC CLS admissions committee should focus on the admissions criteria that produced the strongest relationships with the student performance on the BOC exam. The admissions

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process is important to the TTUHSC CLS program if the data examined here determined that the final admission score might not only predict the student's academic ability and success in the CLS program but also predict whether the student will pass the BOC exam as well. This information is crucial in keeping program attrition rates low by choosing the best applicants to ensure student academic success. In this study, fair yet significant predictors of student success in three of the four categories (TAS, science GPA and non-science prerequisite GPA) indicated that the academically strongest applicants will be the most successful students in the TTUHSC CLS programs. However, with the weak correlation between the traditional students' Academic Scores and their scores on the BOC exam, it seems that there is little relationship to performance on the BOC exam score no matter how high or low these students score on the Academic Score Sheet. Interestingly for the online students, the Academic Score correlation to the BOC result had the highest r value of the four correlations as opposed to the very weak and non-significant traditional students' result. This could indicate that these students might be better equipped to navigate the BOC exam than their traditional counterparts because of their maturity, life experiences, and possession of a degree or degrees.

The findings also demonstrate that while these factors may influence some students' academic success in the TTUHSC CLS programs of study and their eventual BOC scores, they are not absolute. It has been observed in the TTUHSC CLS programs that an entering student with a weak GPA but a high interview score sometimes achieves a high score on the ASCP BOC exam at the end of the program. Factors that this can be attributed are many, including student age, maturity, and previous health-related experiences. Previous studies of student academic and proficiency exam success related to admissions criteria have also indicated this same premise (1-4).

The current study was designed to be a preliminary study of the relationships between admissions data and BOC exam scores only. A further analysis utilizing chi-square statistics will specifically compare admissions requirement scores to the BOC exam scores of students who pass and those who fail the exam. This study will include other independent variables such as sex, age, post-baccalaureate

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education, time of employment in a clinical laboratory, or university attended will be included. Additionally it is of general interest to examine the mean values of ASCP BOC exam scores of the online group of CLS students compared to the traditional face-to-face classroom group, in addition to comparing the mean values of the science GPAs of the traditional students and the online students using a *t*-test. A quick analysis of the t-test results did reveal a very significant difference between the means of the two sets (traditional and online CLS students) of BOC exam scores (p = 0.0063) and science GPAs (p = 0.005). These data, once fully gathered, will be reported in a forthcoming manuscript.

CONCLUSION

How well students may perform in a CLS program is based not only on pre-program GPAs but may further depend upon factors that are difficult to measure. For example, individual maturity, novelty of the curricular material, ability to work in groups, and professional aptitude may mold a student's likelihood of achieving success in any pre-professional academic program. With TTHUSC CLS programs, the predictor of passing the BOC is most likely the student's performance within a program's curriculum, something that was not examined in this study. Regardless, based on the findings of this study, the TTHUSC CLS programs can judiciously use the fair correlations to modestly forecast a student's chance of success in completing the CLS program and successfully passing the BOC exam.

REFERENCES

1. Roush JK, Rush BR, White BJ, Wilkerson MJ. Correlation of Pre-Veterinary Admissions Criteria, Intra-Professional Curriculum Measures, AVMA-COE Professional Competency Scores and the NAVLE. J Vet Med Ed, 2016;41(1), DOI: 10.3138/jvme.0613-087R1

2. Taylor K. Predictors of success to pass the National Physical Therapy Exam: Is there a correlation between GRE/GPA scores and success rates? Undergraduate Honors Theses. Paper 27 (2012); http://dc.etsu.edu/honors/27

3. Utzman RR, Riddle DL, Jewell DV. Use of Demographic and Quantitative Admissions Data to Predict Performance on the National Physical Therapy Examination. J APTA 2007; DOI: 10.2552/ptj.20060222

4. Sandow PL, Jones AC, Peek CW et.al. Correlation of Admission Criteria with Dental School Performance and Attrition. J Dental Ed 2001;66(3) 385-392.

5. Conway-Klaassen JM. An Evidence-Supported Medical Laboratory Science Program Admissions Selection Process. Clin Lab Sci 2016;29(4):227-236.

6. Alaki SM, Yamany IA, Shinawi LA, , Hassan MA, and Tekian A. Can Multiple Mini-Interviews Predict Academic Performance of Dental Students? A Two-Year Follow-Up. Journal of Dental Education. 2016; 80 (11): 1376-1383.

7. Zar, Jerrold H. <u>Biostatistical Analysis</u>, 2nd edition, Prentice-Hall: Englewood Cliffs NJ, 1984, pp. 263-276 and 306-309.

8. "Correlation Coefficient: Simple Definition, Formula, Easy Steps." *Statisticshowto.com* n.p. January 2018, doi February 2018 <http://www.statisticshowto.com/probability-and-statistics/correlation-coefficient-formula/>.

Figure 1. Copy of the Academic Score Sheet Used for the Traditional CLS Applicant

TRADITIONAL CLS PROGRAM APPLICANT
ACADEMIC SCORE SHEET

Student's Name: _____   BID#: _____

A. SCIENCE GPA POINTS	_____	_____	(possible 20)	All prerequisite coursework completed? YES NO
B. CUM GPA POINTS	_____	_____	(possible 15)	**(see course contingency form)**
C. ESSAY POINTS		_____	(possible 15)	

OVERALL SCORE   _____ (possible 50)   # of courses remaining: ____
Comments:

A. CUM. GPA

Grade of C or better in all prerequisite courses?   Yes   No
If no, is there a plan in place to re-take?   Yes   No

If GPA is:	Points
3.86-4.0	15
3.71-3.85	14
3.56-3.70	13
3.41-3.55	12
3.26-3.40	11
3.11-3.25	10
2.96-3.10	9
2.81-2.95	8
2.66-2.80	7
2.5below -2.65	6

B. SCIENCE GPA

Grade of C or better in all science courses?   Yes   No
If no, is there a plan in place to re-take?   Yes   No

If GPA is:	Points
3.91-4.0	20
3.81-3.9	19
3.71-3.8	18
3.61-3.7	17
3.51-3.6	16
3.41-3.5	15
3.31-3.4	14
3.21-3.3	13
3.11-3.2	12
3.01-3.1	11
2.91-3.0	10
2.81-2.9	9
2.71-2.8	8
2.61-2.7	7
2.50 below-2.6	6

D. WRITTEN COMMUNICATION (ESSAY)

Check those that apply (possible total of 15 points):

Well written in grammar and spelling (3/3)   _____
Reflects understanding of the profession (4/4)   _____
Indicative of maturity and sound judgment (4/4)   _____
Informs reader of personal goals. (4/4)   _____

Reader's Name: _____   Score: _____

COMMENTS:

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Figure 2a. Scatterplot of Online Students Total Admission Score correlation to BOC Exam Score
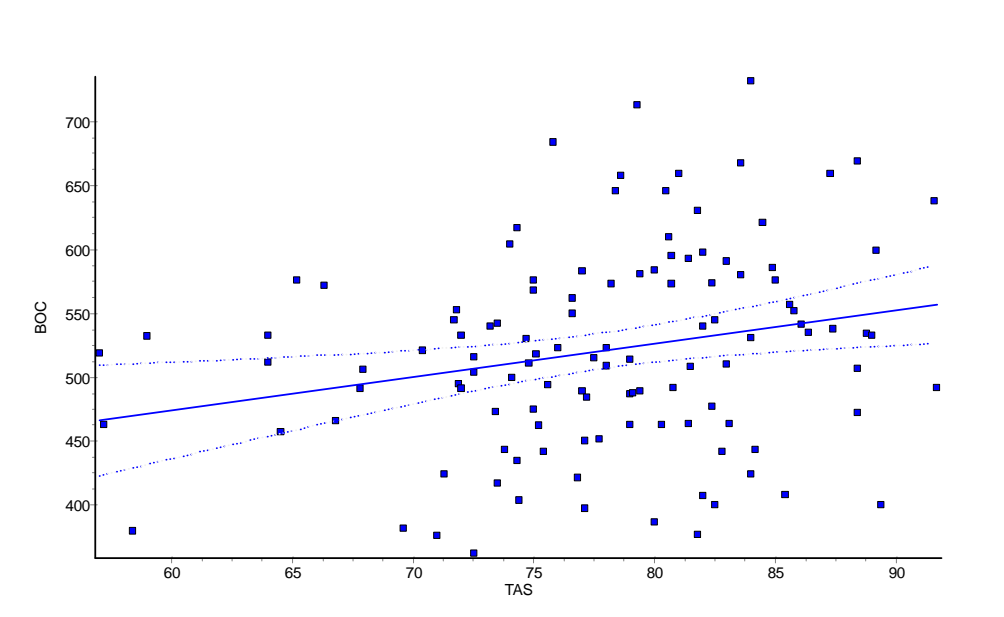

Figure 2b. Scatterplot of Traditional Students Total Admission Score correlation to BOC Exam Score
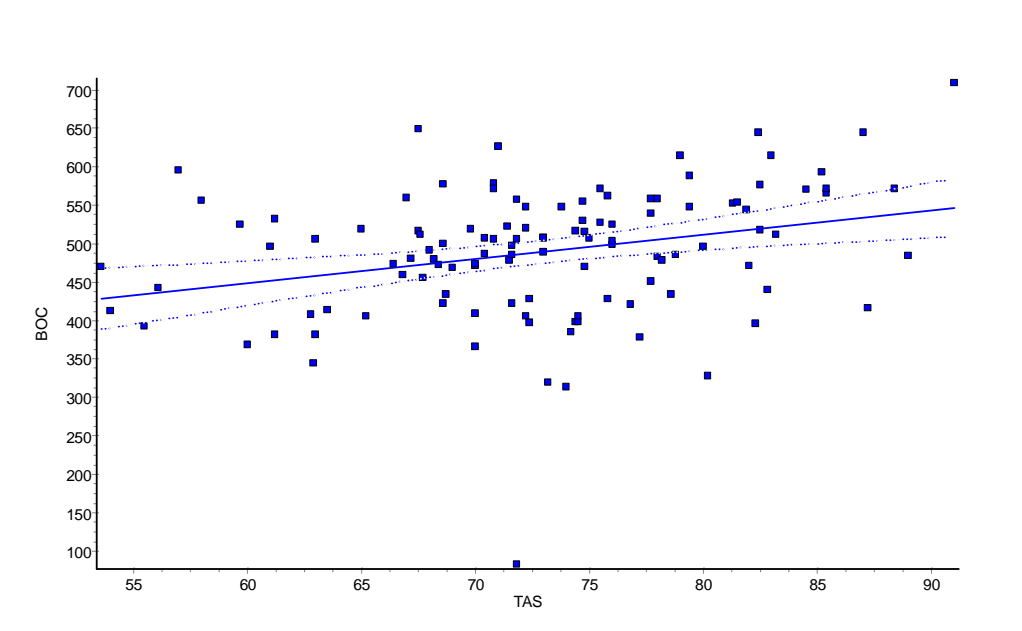
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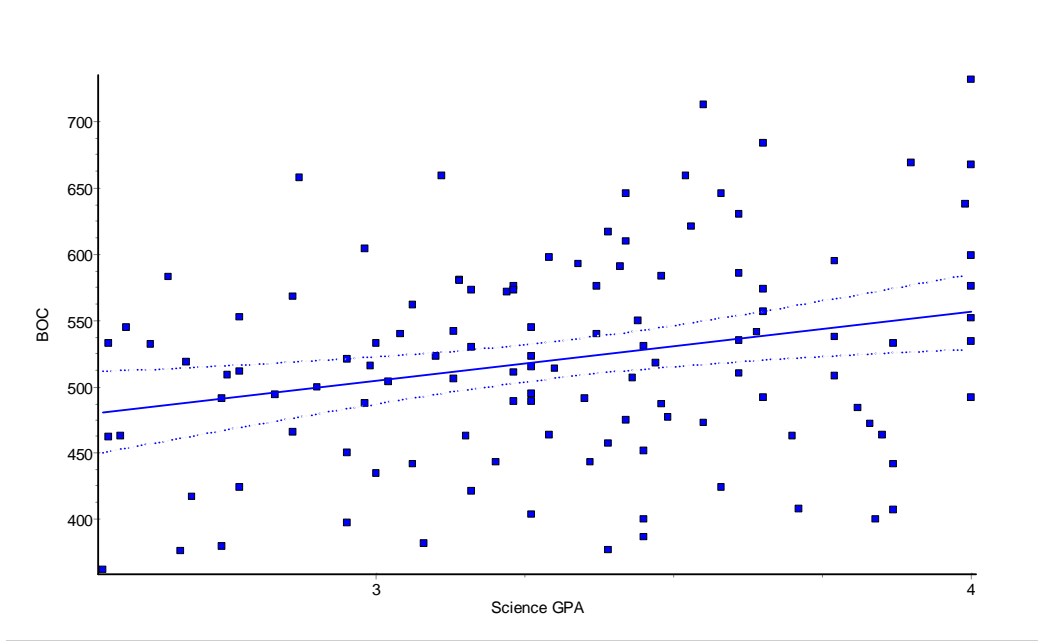Figure 2c. Scatterplot of Online Students Science GPA correlation with BOC Exam Scores

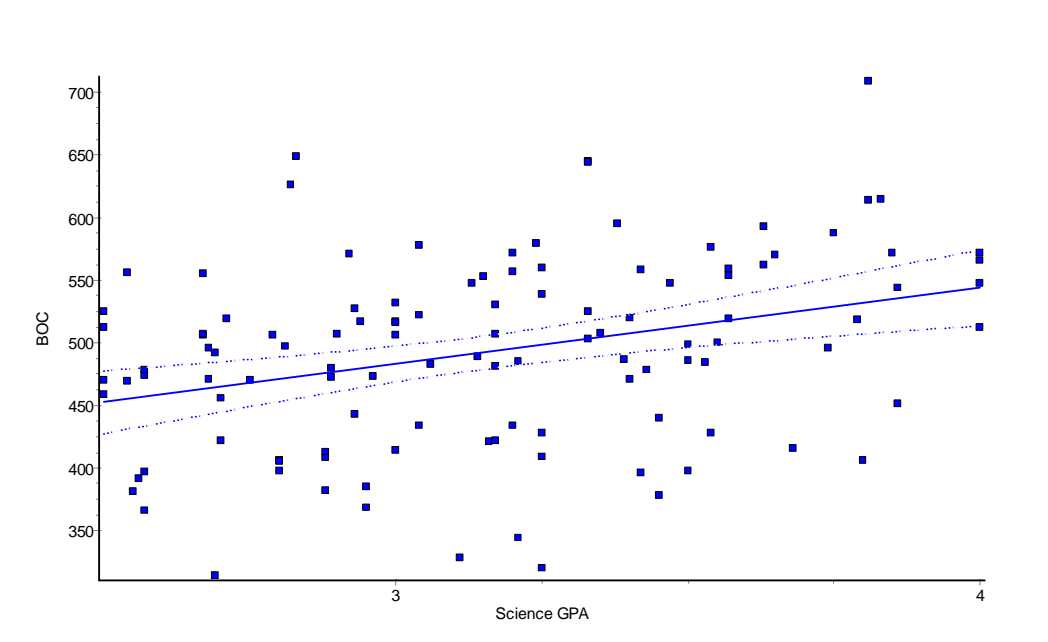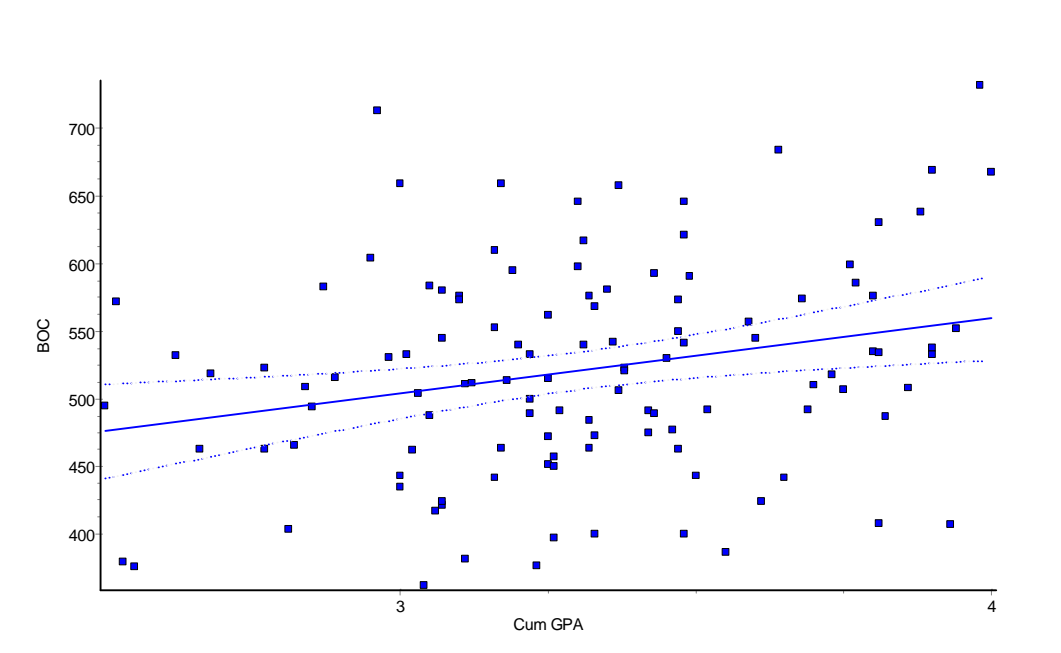Figure 2d. Scatterplot of Traditional Students Science GPA correlation with BOC Exam Scores

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Figure 2e. Scatterplot of Online Students Non-Science GPA correlation with BOC Exam Scores

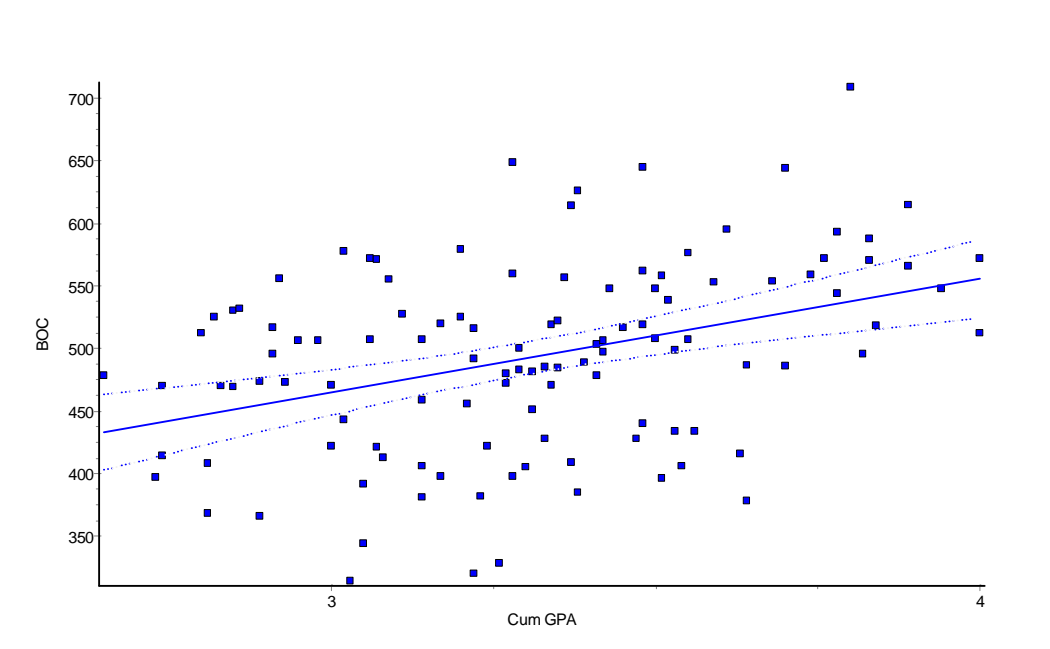Figure 2f. Scatterplot of Traditional Students Non-Science GPA correlation with BOC Exam Scores

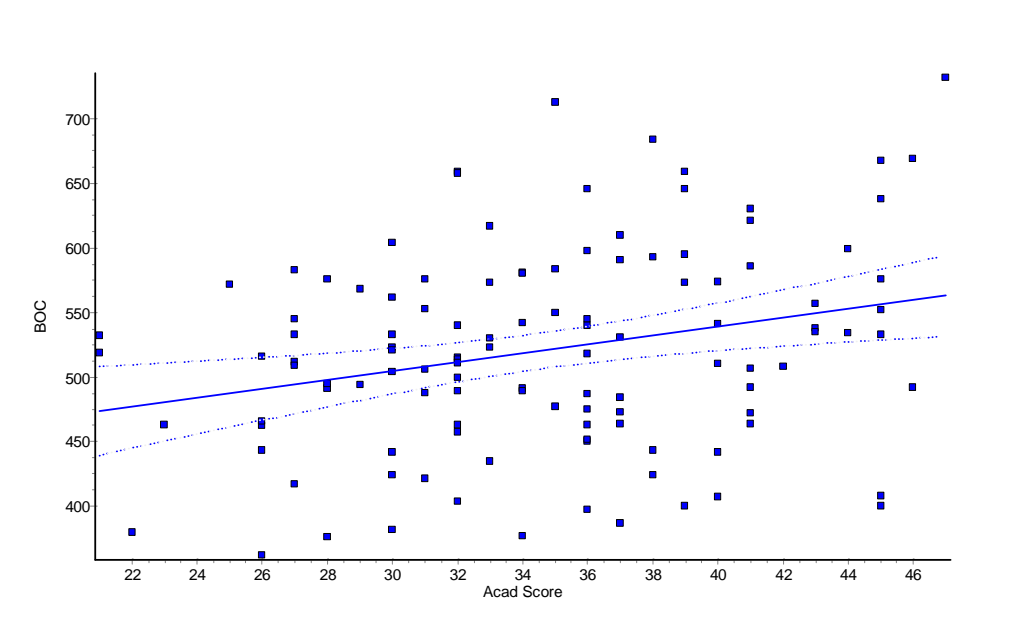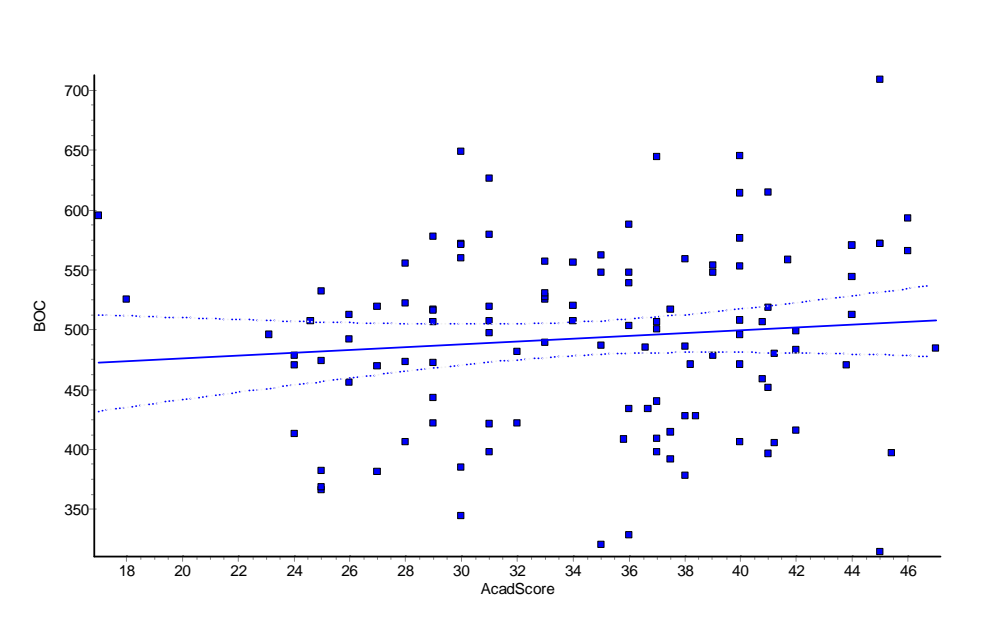Figure 2g. Scatterplot of Online Students Academic Score correlation to BOC Exam Score

Figure 2h. Scatterplot of Traditional Students Academic Score correlation to BOC Exam Score

Table 1. Correlation of TTUHSC CLS Program Admission Criteria with Student BOC Exam Scores

	Correlated to BOC Exam Scores: Traditional CLS Program (r; r^2; p value)	Correlated to BOC Exam Scores: Online CLS Programs (r; r^2; p value)
Total Admission Score*	0.321; 0.103; 0.005	0.239; 0.057; 0.009
Science GPA	0.329; 0.108; 0.003	0.261; 0.068; 0.0045
Non-science GPA	0.381; 0.145; 0.001	0.250; 0.063; 0.007
Academic Score	0.102; 0.0104; 0.277	0.266; 0.070; 0.038

*see Materials and Methods section for clarification