JOURNAL OF RESEARCH IN SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION
DOI: 10.31756/jrsmte.211

Reliability of ACCUPLACER Score in Predicting Success in Quantitative Reasoning Course

Santhosh Mathew

Regis College, USA

Upasana Kashyap

Regis College, USA

Abstract: The purpose of this study was to determine the correlation between the ACCUPLACER placement test score (elementary algebra) and the student success in the quantitative reasoning course at Regis College. Our study points to a weak but significant correlation between the ACCUPLACER placement score and the student success in the quantitative reasoning course. We propose that an in-house placement system based on the unique requirements of the institution will be a much more effective approach to place the students at appropriate levels of instruction.

Keywords: ACCUPLACER; College Placement; Quantitative Reasoning; Freshmen Level Mathematics; Assessment of Student Preparedness

Introduction

There has been a steady increase in the number of students entering US colleges and universities taking remedial courses. According to a report by Manhattan Institute Center for Civic Information (Greene & Foster, 2003) only 32 percent of students leave high school academically prepared for college and this rate is lower among Black (20%) and Hispanic (16%) students. A similar study (Bettinger & Long, 2009) suggest that students in remediation are more likely to successfully complete the college degree than students with similar backgrounds who were not required to take such remedial courses. The placement has been used to identify students who need remedial help before they are enrolled in college level mathematics courses. At Regis College (a 4-year Liberal Arts College located in greater Boston, USA), we employed the College Board's ACCUPLACER program (ACCUPLACER, 2015) for this purpose, which is a computer adaptive placement testing system used to assess students' knowledge

In United States, ACCUPLACER is one of the most commonly used placement tests for developmental mathematics courses at college level. Despite the stakes involved, the validity of these exams has received relatively little attention. While there is a long history of empirical research into the predictive validity of college entrance exams, only a handful of studies have examined these high-stakes college placement exams (Belfied & Crosta, 2012).

Although the College Board reports (ACCUPLACER Reliability & Validity, 2015) the results that support the placement validity of ACCUPLACER scores as a measure for deciding the appropriate college course enrollment for students, they acknowledge that highly

reliable tests may not be valid for a particular purpose. This test is intended to help institutions determine if a student is ready for college-level coursework in particular subjects (mathematics and english) or if developmental work may be necessary. Therefore, an institutional study to measure the reliability of ACCUPLACER is necessary especially when there is a curriculum change. Beginning the academic year 2014-2015, Regis College has replaced traditional algebra courses with a quantitative reasoning course as the freshmen level college mathematics course and that demanded a re-evaluation of the reliability of ACCUPLACER placement test that we have used in the past.

A paper by Scott-Clayton (2012) has found that placement exams are more predictive of success in mathematics courses and more predictive of who is likely to do well in college-level coursework than of who is likely to fail. It is important to note that this study targeted students who were placed in developmental algebra courses based on their placement exam. The quantitative reasoning course offered for freshmen at the college level is on the rise in United States and a literature review reveals that not much attention has been paid to assess the reliability of ACCUPLACER test specifically in a quantitative reasoning course. The purpose of this study was to determine the reliability of ACCUPLACER score in placing students in a quantitative reasoning course by measuring their success in terms of final course grade obtained.

Background

The entry-level mathematics course at Regis College is a quantitative reasoning course offered by the mathematics department. Quantitative reasoning (QR) is the application of basic mathematical skills, such as algebra, to the analysis and interpretation of real-world quantitative information in the context of a discipline or an interdisciplinary problem to draw conclusions that are relevant to students in their daily lives (Elrod, 2014). Topics covered in this course include logic, arguments, reasoning and problem solving, mathematical finance (loan, credit card, mortgage), tax, federal budget, linear and exponential models (population growth) and some geometry related topics.

Students need to complete the quantitative reasoning course before proceeding to other mathematics courses unless they have successfully placed out of this based on their ACCUPLACER college algebra placement score. An important issue for the mathematics department at Regis is the success rate of students especially in entry level mathematics courses, typically taken in the first year. In order to serve the freshman students the best possible way, we placed them in three different categories based on their placement score during the academic year 2014-2015. This test was administered to the freshmen students during the summer months prior to the beginning of the fall semester.

Students were placed in one of the following categories based on their ACCUPLACER placement score:

Prerequisite Model

Students who scored below 70 on the test were placed in a 1- credit remedial course to improve their arithmetic and elementary algebraic skills before proceeding to quantitative reasoning course. In the prerequisite model, students took a 1- credit remedial course in the first semester of their study and after

successful completion of this remedial course they proceeded to the quantitative reasoning course in the following semester (spring 2015).

Corequisite Model

A random group students who scored below 70 on the test were placed in a quantitative reasoning course along with the required remedial course that covered the material from arithmetic and elementary algebra. In this model students took a 4-credit quantitative reasoning course, but they earned a 1-credit towards doing remedial work and 3-credit for successfully completing the quantitative reasoning course.

Quantitative Reasoning Alone

In this model students took a 3-credit quantitative reasoning course without any remedial work as they were placed directly into the quantitative reasoning course. These students scored between 70 and 100 on the test and were allowed to take the quantitative reasoning course without any remediation.

Proper mathematics placement of students is extremely important for Regis College as it has multiple implications such as retention and student success. Studies suggest (Armstrong, 2000) that students who succeed in their first mathematics course are more likely to succeed in college completion and have advantage in terms of progression. Many students often have difficulty in other courses due the lack of adequate preparation in mathematics. For example, several science courses would expect and require students to have a certain level of proficiency in mathematics in order for them to succeed in those courses. The mathematics faculty at Regis College has keen interest in using the ACCUPLACER data to optimize the student placement and as a result the subsequent student success.

Method

The data for this study was collected from 155 students who entered Regis College in the academic year 2014-2015 as freshmen. Out of these 155 students, 46 were paced in prerequisite model, 39 were placed in corequisite model, and 70 were placed in QR alone. Additionally, for this study we created two more categories by identifying students who received B- or above (class average of 80% or above) and C- (class average of 70% or above) or above letter grade. We collected the ACCUPLACER test scores of all these students. The class average calculations are discussed in detail in the paragraph following the next one.

All these classes were taught by three different instructors but had a common syllabus and common grading options. The tests, quizzes and homework assignments were also similar in content as much as they have been taken from a common pool of questions from the textbook. The textbook used for these classes was ``*Using and Understanding Mathematics: A Quantitative Reasoning Approach"* by Bennet and Briggs (2014). The homework assignments were completed using Pearson online homework module MyMathLab. However, the tests and quizzes were done in the class, proctored by the instructors.

We used the student class average score as an indicator of their success in this course. These averages were calculated using weighted average formula comprising quizzes (12%), three semester tests (48%), online homework (16%), attendance (4%) and final exam (20%). The data collection was complete in the fall

2014 for the students who completed the quantitative reasoning course either as corequisite or QR alone. However, for the students in prerequisite model we had to wait until the end of spring 2015 to have the complete data. These students completed the perquisite in fall 2014 and then took the quantitative reasoning course in spring 2015.

We used statistical software SPSS (version 24) to analyze the data. In order to identify how the ACCUPLACER placement score would have impacted the student performance in three different models of QR courses, we compared the ACCUPLACER scores and class average for each of these models. Additionally, the same comparison was done for the entire sample. At Regis, C- (C minus) is the minimum grade needed to proceed to any higher level math courses and, students with B- or above (B minus or above) are considered to be in good academic standing. Therefore we examined the data for the students in these categories as well. We computed the sample Pearson correlation coefficient (r) and its standard error for all the above categories. We also calculated mean, standard deviation for ACCUPLACER score and class average. Then, to test if the correlation coefficient, r, is statistically significant, we obtained the p-value to reach the conclusion. We also constructed a 95% confidence interval for correlation coefficient.

Results and Discussion

The results of this study are given in Table 1. To analyze the results effectively we created several categories of data: all students, students in corequisite model, students in prerequisite model, students in QR alone, students who earned a grade of C- or higher and students who earned a grade of B- or higher.

Table 1

Overall Relationship between ACCUPLACER Test Score and Class Average for Different Categories of Students

ACCUPLACER score vs Class Average	N	$\overline{X}$	σ_X	$\overline{Y}$	σ_Y	r	SE_r	p-value	95% confidence interval of r
All students	155	66.38	17.44	73.40	14.98	.28	0.08	.00	(.13, .42)
Corequisite model	39	59.77	7.12	76.14	16.55	.17	0.16	.16	(-.15, .46)
Prerequisite model	46	48.87	10.86	66.94	15.12	.20	0.15	.09	(-.10, .46)
QR alone	70	81.57	10.53	76.11	12.70	.19	0.12	.06	(-.05, .41)
C- or above	106	69.01	16.41	81.70	7.56	.15	0.10	.06	(-.04, .33)
B- or above	67	69.13	16.87	86.32	5.21	.26	0.12	.02	(.02, .47)

Note. N=sample size, $\overline{X}$ = Mean of ACCUPLACER score, σ_X = standard deviation of ACCUPLACER score, $\overline{Y}$ =Mean of class average, σ_Y = standard deviation of class average, r = Pearson correlation coefficient, SE_r = Standard Error, p = p-value.

In general, our study established a weak but significant correlation between the ACCUPLACER test scores and the success in quantitative reasoning course. For the entire sample, our results show a weak but significant correlation ($r = .28$, $p < .001$) between ACCUPLACER score and course average. Our results

indicated a weaker correlation for students in corequisite and prerequisite course models. As evident from Table 1, the correlation coefficient between ACCUPLACER score and class average for each model is: corequisite ($r = .17$, $p = .16$), prerequisite ($r = .20$, $p = .09$) and QR alone ($r = .19$, $p = .06$). These results do not indicate a significant correlation between ACCUPLACER score and course average in any of these three course models. Similarly, our results show a weak but significant correlation between ACCUPLACER score and course average for the group of students who earned a grade of B- or higher ($r = .26$, $p = .02$). However, this relationship is weaker for the group of students who earned a grade of C- or higher ($r = .15$, $p = .06$).

We also calculated the 95% confidence interval for each group and the results are displayed in Table 1. For the whole group and the students with B- or higher grade the confidence interval does not includes 0, which reconfirms that the population correlation coefficient, r, is significant. However, for corequisite, prerequisite, QR alone, students with C- or higher grade the confidence interval includes 0, which shows that the correlation coefficient, r, is not significant.

Our findings are similar to several other studies that showed mixed results on the validity of placement testing (Mattern & Packman, 2009; Armstrong, 2000). However, we would like to acknowledge that there were a few limitations associated with our study, which restricted the analyses and generalizability of the results. First, we had the data from only one academic year (2014 - 2015). Although our finding agrees with several other studies suggesting that ACCUPLACER alone is not the measure of student's future success (Mattern & Packman, 2009), we recommend the need for further study that investigate the role of ACCUPLACER score in predicting students' success in quantitative reasoning course at various institutions. We support the suggestion that to improve placement accuracy in developmental math and increase access to higher-level courses institutions could consider multiple measures of student preparedness in their placement rules (Ngo & Kwon, 2015). Another study (Scoot-Clayton, 2012) has shown that utilizing multiple measures to make placement decisions could reduce severe misplacements by about 15% without changing the remediation rate, or could reduce the remediation rate by 8% to 12% while maintaining or increasing success rates in college-level courses.

Conclusion

Our study points to the fact that ACCUPLACER placement score could not be considered as an indicator for initial placement since it can't serve as the sole predictor for student success. The student success in quantitative reasoning course, similar to any other course, would also depend on non-cognitive skills (Anthony, 2000) not determined by ACCUPLACER test alone. Studies have shown that (Sedlacek, 2004) placement test is a good indicator to assess cognitive skills, however, they do not measure other factors that are equally important to student success. These factors include such things as attitude toward learning, motivation, autonomy, willingness to seek and accept help, desire to affiliate with peers or instructors, or willingness to expend effort on academic tasks. However, a streamlined and cohesive placement process will enable the faculty to outline the best pedagogical approach to serve different segments of the student body. As an alternative for ACCUPLACER, we propose an in-house placement

system based on the unique requirements of the institution which will be a much more pragmatic method to place the students at appropriate levels of instruction. Based on this study, beginning the academic year 2017-2018 at Regis we replaced the ACCUPLACER test with an in-house placement system along with high school GPA (Grade Point Average) to identify the student's level of preparation for quantitative reasoning course.

References

Anthony, G. (2000). Factors influencing first-year students' success in mathematics. *International Journal of Mathematical Education in Science and Technology 31*(1), 3–14.

Armstrong, W. B. (2000). The association among student success in courses, placement test scores, student background data, and instructor grading practices. *Community College Journal of Research & Practice*, *24* (8), 681– 695.

Belfield, C. R., & Crosta, P. M. (2012). *Predicting success in college: The importance of placement tests and high school transcripts* (CCRC Working Paper No. 42). New York: Community College Research Center.

Bennett, J., & Briggs W.L. (2014). *Using and understanding mathematics: A Quantitative Reasoning Approach.* 6th ed., MA: Pearson.

Bettinger, E. P., & Long, B. (2009). Addressing the needs of under-prepared students in Higher Education: Does college remediation work? *Journal of Human Resources*, *44*(3), 736–771.

Brase, C. H. & Brase, C.P. (2012). *Understandable Statistics: Concepts and Methods* (10th edn). Boston: Brooks/Cole Cengage Learning.

College Board. (2015, March 12). ACCUPLACER. Retrieved from

http://professionals.collegeboard.com/higher- ed/placement/ACCUPLACER.

Elrod, S.L. (2014). Quantitative Reasoning: The Next "Across the Curriculum" Movement, *Peer Review 16*(3), 4–8.

Greene, J.P. & Forster, G. (2003, September). *Public High School Graduation and College Readiness Rates in the United States*, (Manhattan Institute, Center for Civic Information, Education Working Paper, No. 3). New York: Manhattan Institute.

Madison, B. L., Linde, C. S., Decker, B. R., Rigsby, E. M., Dingman, S. W., & Stegman, C. E. (2015). A Study of Placement and Grade Prediction in First College Mathematics Courses. *PRIMUS*, *25*(2), 131-157.

ACCUPLACER Reliability & Validity (2015, May 20). Retrieved from
https://accuplacer.collegeboard.org/sites/default/files/accuplacer-realiability-validity.pdf

Mattern, K. D., & Packman, S. (2009). *Predictive validity of ACCUPLACER scores for course placement: A meta-analysis* (Research Report No. 2009-2). New York, NY: College Board. Retrieved from

https://research.co.llegeboard.org/sites/default/files/publications/2012/7/researchreport-2009-2-predictive-validity-ACCUPLACER-scores-course-placement.pdf

Ngo, F., & Kwon, W. W. (2015). Using multiple measures to make math placement decisions: Implications for access and success in community colleges. *Research in Higher Education*, *56*(5), 442-470.

Rueda, N. G., & Sokolowski, C. (2004). Mathematics placement test: Helping students succeed. *The Mathematics Educator*, *14*(2), 27-33.

Scott-Clayton, J. (2012). *Do high-stakes placement exams predict college success?* (CCRC Working Paper No. 41). New York, NY: Columbia University, Teachers College, Community College Research Center.

Sedlacek, W. E. (2004). *Beyond the big test*: *Noncognitive assessment in higher education*. San Francisco: Jossey-Bass.

Steen, L. (2004). *Achieving Quantitative Literacy: an Urgent Challenge for Higher Education*. MAA Notes. Washington, DC: Mathematical Association of America.

Corresponding Author Contact Information:

Author name: Santhosh Mathew

Associate Professor of Physics, Astronomy & Mathematics, Department of STEM

University, Country: Regis College, USA

Email: santhosh.mathew@Regiscollege.edu

Please Cite: Mathew, S., & Kashyap, U. (2019). Reliability of ACCUPLACER score in predicting success in Quantitative Reasoning Course. *Journal of Research in Science, Mathematics and Technology Education*, *2*(1), 1-7. doi: 10.31756/jrsmte.211

Received: October 25, 2018 ▪ Accepted: December 12, 2018