

QLRA Analysis

M. Leigh Lunsford, Phillip L. Poplin, and David Shoenthal
Department of Mathematics and Computer Science
Longwood University

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Introduction

The Problem:

- Multiple Assessments Being Used:
 - QLRA
 - ALEKS
 - Basic Skills Quiz
- Would like to simplify and reduce work required to administer and analyze all of these assessments.

Question

We were interested in determining whether the scores on the QLRA were a predictor of success in MATH 164 and/or MATH 171. If so, then we could reduce the number of assessments taken by students and analyzed by faculty.

QLRA

The *Quantitative Literacy and Reasoning Assessment* (QLRA) is the instrument used to assess quantitative reasoning as a SCHEV (State Council of Higher Education for Virginia) core competency. We seek an increase in score from freshman year to senior year.

- First used in 2014-2015 year.
 - Replaces previous QR assessment instrument
- Developed under NSF funding.
 - More focused on proportional reasoning
- Administered on-line to all Freshmen during orientation.
- Administered to random sample of Seniors in Spring.
- Free.
- *Statistically* significant increase in scores.

<http://serc.carleton.edu/qlra/index.html>

ALEKS

ALEKS is an assessment tool given to Precalculus students to assess their algebra readiness before entering Precalculus (MATH 164). This test was put into place in part to address the success rate in calculus in terms of Longwood's Level II certification.

- Commercial on-line tool.
- Cost passed on to students.
- Administrative burden.

MATH 164

- Precalculus (MATH 164) at Longwood University
 - No prerequisites.
 - Lots of algebra.
 - ALEKS assessment used to determine basic algebra skills before entrance to the class.
 - Initial ALEKS score used as indicator for required tutoring program similar to what was done in MATH 171.

Basic Skills Quiz

The Basic Skills Quiz is given to Introductory Statistics students to assess basic mathematics skills at the beginning of MATH 171. An initial study showed it predicted success in MATH 171. It was used in a second study to determine if students were required to have tutoring in MATH 171.

- Published in the *Journal of Statistics Education*.
- Administered via paper and pencil.
- Mostly covers ratios and very basic algebra.
- Free.

Previous Work in MATH 171

- Lunsford, M. L. and Poplin, P., “From Research to Practice: Basic Mathematics Skills and Success in Introductory Statistics,” *Journal of Statistics Education*, v 19(1), 2011.
- Using Assessment to Increase Student Success in Introductory Statistics (MATH 171) (LAMP grant 2012)
- Assessment with a Purpose: Improving Introductory Statistics at LU (LAMP grant 2013)

Understanding Our Students

- Low Success Rates in Introductory Statistics (MATH 171)
 - Only 54% of students completing course with grade of C or better.
- A general education course, service course to other disciplines.
- Emphasis on concepts instead of computations.
- Professors make extensive use of calculator.
- Used a Basic Skills Test* to measure incoming fundamental math skills.
 - Administered first day of class.

*Johnson, M. and Kuennen, E., "Basic Math Skills and Performance in an Introductory Statistics Course," *Journal of Statistics Education*, V 14(2), 2006.

Previous Work in MATH 171

First Study*

- 3 semesters
 - Spring 2007 – Spring 2008
- 4 Professors
- 500 Students
- No Intervention

Second Study

- 6 Semesters
 - Fall 2011 – Spring 2014
- 7 Professors
 - 3 also in First Study
- 1355 Students
- Required Intervention for high risk students.

The same 20 question Basic Skills Test used in both studies.

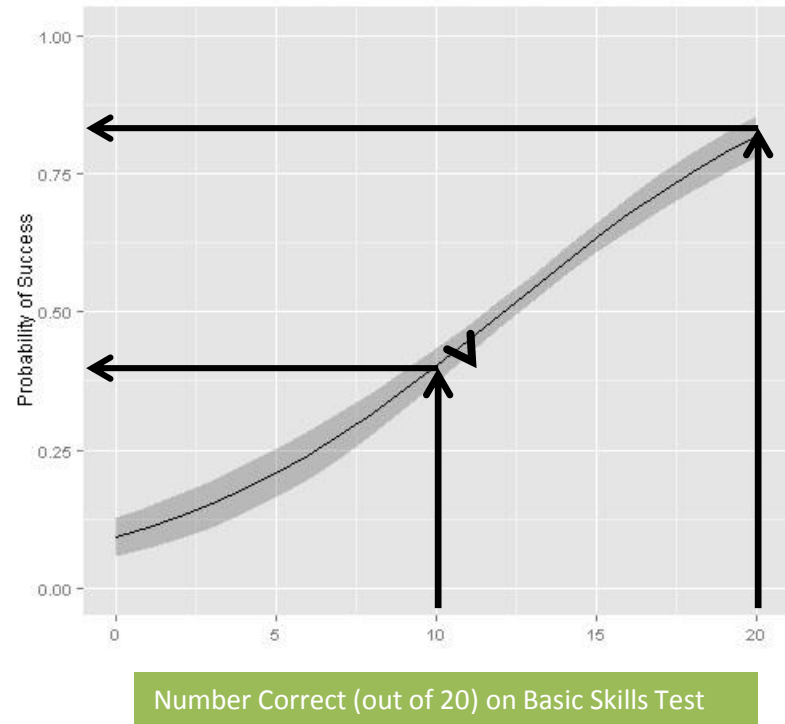
*In our JSE publication about the First Study we included Fall 2006 since we only reported results from the 15 question Basic Skills Test.

Main Result from First Study

Students with low basic mathematics skills were less likely to be successful (A, B, or C) in MATH 171.

- A typical student who scored 10 on the 20-question basic skills test had an approximate 40% chance of success in the course and one who scored 20 had an 80% chance.
- Band is ± 1 SE

The Basic Skills Test is a fair predictor of student success.



Second Study

Use basic skills test to identify students who are not likely to be successful (“at-risk”) and require early intervention.

Early Intervention: Students who score 50% or below on Basic Skills Test required to attend at least 6 hours of tutoring in Center for Academic Success (CAS) before midterm.

Second Study Overall Results

The percent of *all* MATH 171 students who were successful increased by 11 points from 54% to 65%. This was significant ($z = 4.3, p < 0.001$).

	Success	Failure	Total
First Study	269 (53.8%)	231	500
Second Study	877 (64.7%)	478	1355

A Closer Look at Early Intervention

**Students Who Scored 50% or Lower
(Required Intervention in Second Study)**

	Success	Failure	Total
First Study	47 (38.5%)	75	122
Second Study	177 (54.0%)	151	328

There was a 15.5 point increase in percent successful in this group.

**Students Who Scored Above 50%
(No Required Intervention in Either Study)**

	Success	Failure	Total
First Study	222 (58.7%)	156	378
Second Study	700 (68.1%)	327	1027

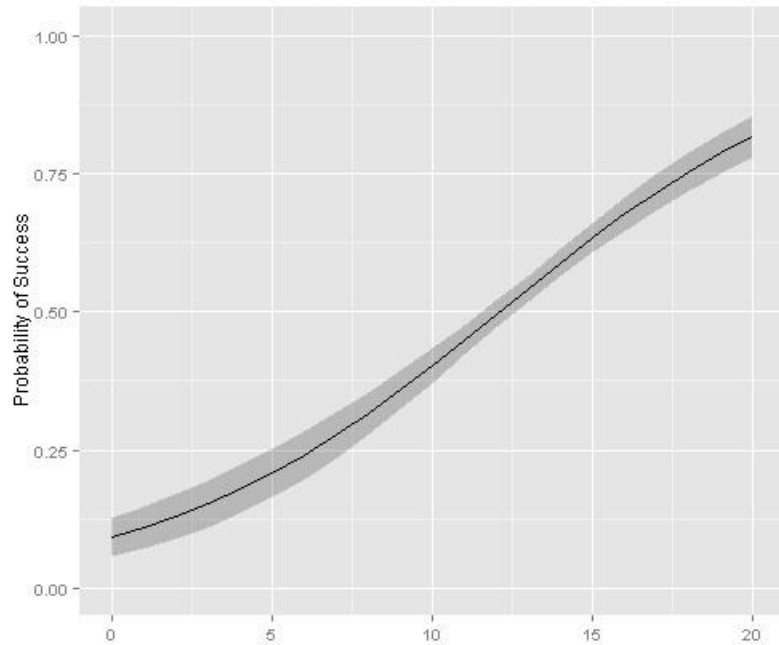
There was a 9.4 point increase in percent successful in this group.

The increase in success for students who scored 50% or lower was significantly* higher in the second study (i.e. with required intervention).

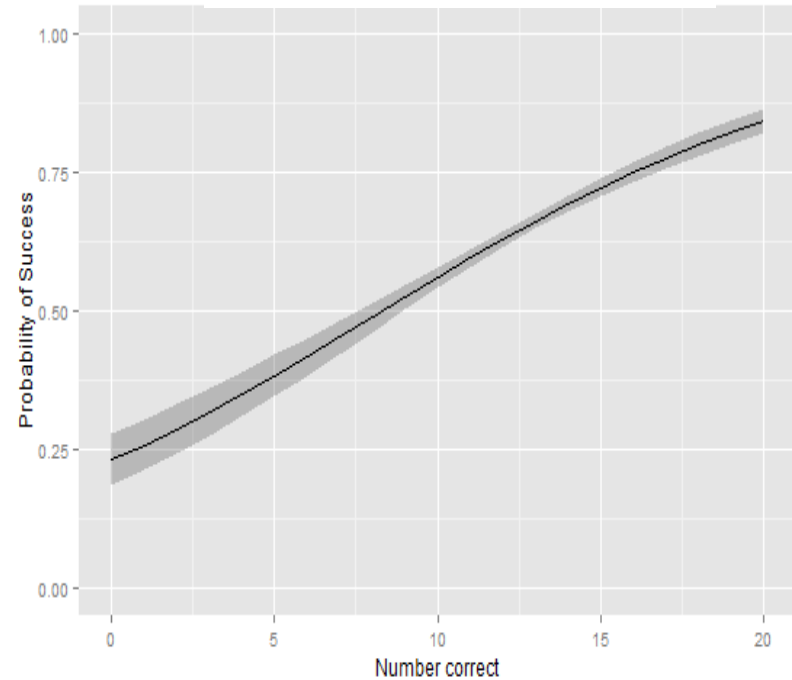
***Cochran-Mantel-Haenszel Test, $p < 0.001$.**

Basic Math Skills *Still* a Fairly Good Predictor of Success

First Study



Second Study



Number Correct (out of 20) on Basic Skills Test

Notice the shift up, especially in the lower portion, in the success curve.

Back to Our Question

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Methodology

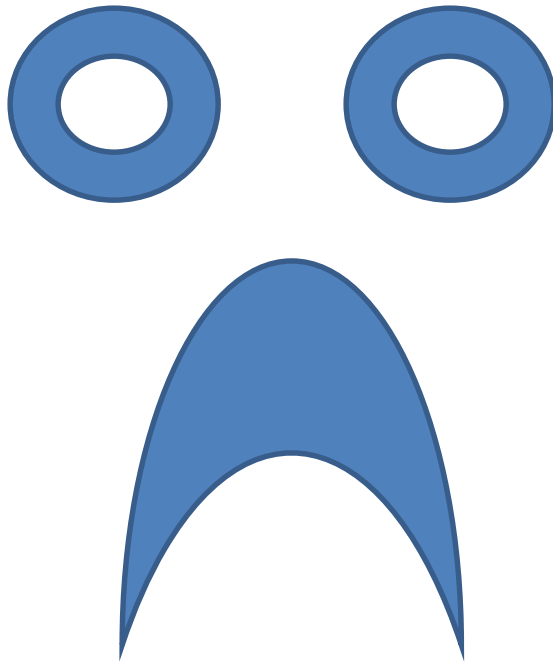
Data from the 2014-2015 academic year.

- QLRA scores of students in either MATH 164 or MATH 171.
- Grade in the class, coded as success or failure.
- Also included question-by-question results.

We used binary logistic regression to analyze the data.

Basic Result

No association between QLRA scores and success in either MATH 171 or MATH 164.



New Assessment

Changed the QLRA assessment given to all entering Freshmen.

- Include questions from old QLRA
- Include some questions from Basic Skills Quiz

Questions were chosen so that we minimized duplication of question topics or skills, and considered predictive value of questions.

Current Data Collection

In Fall 2015 the new QLRA was administered to all incoming freshmen. Required tutoring for both courses was removed in order to determine whether the new assessment has predictive value. We are continuing this in the spring.

Future Work

- Analyze data by overall score and question to determine whether the new QLRA can serve as a predictor of success in either class.
- Determine whether this test will accurately assess quantitative reasoning under General Education reform.

Thank you!

M. Leigh Lunsford

lunsfordml@longwood.edu

Phillip L. Poplin

poplinpl@longwood.edu

David Shoenthal

shoenthaldw@longwood.edu