

Running Head: Using STAR math test to predict algebra 1 EOC scores.

A STUDY OF THE PREDICTIVE VALIDITY OF THE STAR MATH TEST FOR THE
ALGEBRA 1 END OF COURSE EXAM

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Abstract

This is a study on the predictability of the algebra I End of Course scores based on a student's eighth grade STAR math test score. For this study, End of Course scores for algebra I were gathered from 200 freshmen students at a suburban Midwestern high school as well as STAR math test scores from those same 200 students from their eighth grade year. A simple linear regression was performed to determine if in fact a student's STAR math score from their eighth grade year could predict their score on the algebra I end of course test the following year. The reason for the study was if given the opportunity to earlier identify students in need of extra interventions, teachers could then have those interventions in place at an earlier time and thus providing the student with the needed support for a longer period of time. It was found that STAR math test scores are a valid predictor of algebra I End of Course scores and could be used to identify students in need of extra interventions. It was also recommended that further research be done to determine not only a way to predict such scores but also the best way to predict such scores.

Introduction

Background, Issues and Concerns

Standardized testing has become attached to high stakes in education today with the onset of the No Child Left Behind Act of 2001. Teachers and administrators are looking for ways to predict test scores and therefore be able to get remediation for students who are identified as in need. Since teachers are not allowed to see the test before it is given and simply have a list of standards to go by, it can be hard for educators to produce their own tests or benchmarks that can accurately predict the results of the state test at the end of the year. Because of this, educators have turned to test making companies for help. One such company is Renaissance Learning Incorporated. The STAR math test is a computer-adaptive assessment that was created by Renaissance Learning Incorporated to test student's knowledge of mathematical concepts and give the student's grade level based on how they answer questions. It also quickly provides feedback about the student's areas of struggle. In a suburban Midwestern high school, the STAR math test is given in all algebra 1, algebra 2, and geometry classes. It is also given at the feeder middle school, to all eighth graders.

Practice under Investigation

The practice under investigation is using STAR math scores to predict algebra 1 End of Course scores.

School Policy to be Informed by Study

A Midwestern suburban district with four high schools, gives the STAR math test to all eighth graders and all students enrolled in algebra 1, geometry, and algebra 2. If it is found that the STAR math test can accurately predict algebra 1 End of Course scores, educators can use that knowledge to predetermine struggling students and proactively get them the help that they need to be successful on the algebra 1 End of Course exam, such as getting them in special study halls.

Conceptual Underpinning

At a Midwestern suburban high school, an incoming freshman student's STAR math score, as well as their math grade from the previous year is used to determine the student's math competency. At this high school, there is no honors algebra 1 offered because the advanced students take geometry. Without the student's knowledge, an advanced algebra class is then scheduled that covers all the same material as the other algebra 1 classes and gives the same homework and tests. It also appears on the schedule the same but has a little more time to go a bit further into the material because of the pace they are able to move. STAR math scores and previous grades are used to determine the students that are placed in this class. This high school also requires students to take a flex class, which is a class that gives them time to visit other teachers, take tests, or work on homework. Some of these classes are specially scheduled with a math teacher with kids that have been identified as being on the bubble of scoring basic or the low end of proficient on the algebra 1 EOC. The purpose of these classes is to provide students with the extra support they need to be successful in algebra 1 and on the algebra 1 EOC.

Currently STAR math scores and previous grades are used to schedule these classes. It was found that previous grades are not always the best indicator of the student's actual understanding of the material and students identified this way are not always in need of the assistance and some students that are of looked over. This is why the validity and the predictive ability of the STAR math test needs to be tested.

Statement of the Problem

In today's educational system, high stakes standardized testing has become the norm. Funding as well as the quality of a school is based on how its students perform on these tests. Because of this and the No Child Left Behind Act of 2001 stating that by 2014 all students will be proficient at reading and math, educators are feeling the pressure to do what they can do get struggling students help before test time. The problem comes in finding a measurement tool that can accurately predict student scores on the states end of the year test so that educators can identify struggling students and get them the needed remediation.

Purpose of the Study

The purpose of this study is to determine if the STAR math test is a valid predictor of algebra 1 End of Course scores. If it is a valid predictor, the knowledge gained will help algebra 1 teachers identify students in need of remediation or extra assistance before the school year begins.

Research Question(s)

Does the STAR math test have predictive value for algebra I End of Course scores?

Null Hypothesis

The null hypothesis is that the STAR math test does not have a predictive value for algebra 1 End of Course scores.

Anticipated Benefits of the Study

If it is found that the STAR math test can accurately predict algebra 1 End of Course scores, educators can use that knowledge to predetermine struggling students and proactively get them the help that they need to be successful on the algebra 1 End of Course exam.

Definition of Terms

NCLB – The No Child Left Behind Act of 2001 is an act of congress concerning public schools. This act supports standards based education and requires states to make standardized tests to be given to students at certain points in their educational career and sets standards for those students to meet in order for the school to receive federal funding. It is the goal of the bill to have 100% of students at proficient or advanced in math and communication arts by 2014.

AYP- NCLB requires schools to show annual yearly progress (AYP) towards meeting the goal of 100% in 2014. Schools that do not meet the goal do not meet AYP and face repercussions laid out in NCLB.

EOC – An End of Course test (EOC) is a state test given in Missouri high schools at the completion of certain classes. Algebra 1, communication art 2, and biology are EOC's that count for AYP.

STAR math test – The star math test is a computer-adaptive assessment that was created by Renaissance Learning Incorporated to test student's knowledge of mathematical concepts then gives the student a score and the student's grade level based on how they answer questions

Summary

A Midwestern suburban school gives students the STAR math test at various points in their education career. This study investigates the validity the STAR math test has in predicting student scores on the algebra 1 End of Course exam. If its predictive value is valid then this information could be used to proactively get struggling students the help that they may need to be successful.

Review of Literature

A trend in American education is requiring schools to give high stakes tests that show all students are learning. According to a release from the Missouri Department of Elementary and Secondary Education (DESE) titled *Understanding Your Annual Yearly Progress*, the *No Child Left Behind Act (NCLB) of 2001* requires all schools and school districts to show this progress by meeting annual proficiency targets on such tests in order to meet AYP (Annual Yearly Progress). DESE has set that the Algebra I End of Course (EOC) exam and the English II EOC will be used as indicators for meeting proficiency targets and thus meeting AYP. Failure to meet AYP for 2 or more consecutive years gets a school labeled with the status of School Improvement and further consequences are set out in NCLB.

One result of high stakes testing is teachers giving various benchmarks in order to attempt to predict what level a student is performing at. One such benchmark is the STAR Math test. *Getting the most out of star math: using data to inform instruction and intervention* (2010) is an informational guide released by the company Renaissance Learning Incorporated over their product, the STAR math test. It discusses all aspects of the test including for whom it is made, how they should take it, when they should take it, the content involved, and how to interpret the results. It is made for students kindergarten through high school to be taken twice a year, usually once in the fall and once in the spring. What the program is is a computer diagnostic test to determine at what grade level a students math skills are currently at. The test itself is only about 15 minutes long and the level of difficulty of the questions varies depending on if the student is getting questions correct or not. An important aspect of this test is that students are only allowed

a pencil and scratch paper and should take this test seriously, just as they would for any other test. The report *STAR math computer-adaptive math test: understanding reliability and validity* (n.d.) also released by Renaissance Learning Incorporated explains the reliability and validity of the test to state standardized tests around the nation. It takes tests from various areas of the nations (northeast, midwest, southwest, and west regions) and shows the results of their studies as reasons as to why this is a reliable and valid way to predict state test scores. One reason it gives for its reliability is the way that they question for the students change ability level as the students are taking it depending on how they answered previous questions. It also provides the teacher with a margin of error for students. For validity there are tables in which you can see the correlation coefficient that tells you how strong the relationship is between the STAR score the and state's test score.

One study done over the predictability of the STAR math test was done by Conner called *The STAR Math Test as a Predictor of Arkansas Benchmark Test Scores* (2009). This is a study done over the validity of the using the STAR math test to predict student scores on the end of year Arkansas Benchmark test. This study was done on sixth, seventh, and eighth grade students in a middle school in Arkansas over a three-year time period. It was found that the STAR math test could be used as a valid predictor of scores on the Arkansas Benchmark Test (Conner 2009).

Brown and Coughlin's *The predictive validity of selected benchmark assessments used in the Mid-Atlantic Region* (2007) reports on a study done in the mid-Atlantic states on whether or not certain benchmarks are a valid way to predict students test scores on state standardized tests. The benchmarks they chose to use are company generated

benchmarks and not locally generated benchmarks. They tested 4 different benchmarks: Northwest Evaluation Association's Measures of Academic Progress (MAP; Northwest Evaluation Association, 2003) Renaissance Learning's STAR Math/Reading (Renaissance Learning, 2001a, 2002), Scholastic's Study Island (Study Island, 2006a) and CTB/McGraw Hill's TerraNova (CTB/McGraw Hill, 2001b). They found that there was some sort of validity for the MAP, STAR, and TerraNova but that overall the TerraNova was the most valuable for predictive scores.

However the article *Can an Intelligent Tutoring System Predict Math Proficiency as Well as a Standardized Test?* by Feng, Beck, Heffernan, and Koedinger (2008) would say otherwise. This article discusses some of the flaws with solely using computer programs such as Renaissance Learning programs to predict state test scores. The article says that even though they give the teacher data, it does not store enough data to look at the trends. It also suggests that it does not take into consideration the students willingness to get help. This article suggests that the The ASSISTment system may be a better way to predict test scores because it blends benchmarking and computer based systems into one system that helps students work through problems while collecting data on accuracy, speed, help-seeking behavior, and number of attempts.

In the article *Measuring how benchmark assessments affect student achievement* Henderosn, Petrosino, Guckenbug, and Hamilton (2007) researched to see if giving quarterly benchmarks increases student achievement. For this study, quarterly benchmarks were given to 22 school districts in Massachusetts, when were then compared to 44 other school districts. What was found was that there was no significant difference in the schools that were given the benchmarks and those that were not. It did

say that there could be some problems with the data though. One problem being they don't know what the 44 districts that the 22 were compared to were doing on their own. The second being that the sample sizes were not the same so a small but important difference could have gone undetected because there were only 22 program schools and 44 comparison schools. Finally, they only had one year of data to compare so it may still be too early to see the differences occurring. Bancroft (2010) also supports this study in the article *Implementing the mandate: the limitations of benchmark tests*. This article is over a study done in a lower socioeconomic school in California, specifically in language arts classrooms, over the effects of implementing benchmarks into their classroom. Going into the study they wanted to know if benchmarks were a valid means of informing teachers of what was being learned and what still needed to be covered or re-covered in order to raise achievement in their classrooms. What they found was that teachers and administrators both found that the benchmarks did not do what they wanted and did not adequately show the students progress.

After reviewing several articles and other researchers' findings, it was clear that further research needed to be conducted on this topic. Though currently standards differ in every state as well as proficiency levels, education in America is coming to a point where that may change. One thing that does not seem to be changing however is high stakes testing. Because of this, any method that proves to help teachers better understand what level their students are on and what needs to be improved upon is valuable. Through this research, a conclusion can be drawn about the predictability of the STAP math test on the Algebra I End of Course scores.

Research Methods

Research Design

The collection of STAR math scores and end of course scores from the previous 2 years at a suburban Midwestern school served as the design model. The alpha level was set at 0.25 for all tests in this research. The independent variable was the STAR math scores and the dependent variable was the End of Course scores. A simple linear regression was run to determine if STAR math scores can predict End of Course scores.

Study Group Description

The study group for this research was 200 students that took algebra 1 at a Midwestern suburban high school in 2010-2011.

Data Collection and Instrumentation

STAR math scores were collected for incoming freshmen from the end of student's eighth grade year. The same student's algebra 1 End of Course scores were also collected for the 2010-2011 school year.

Statistical Analysis Methods

Microsoft Excel was used to compile data for this research then A Statistical Package (ASP) software was used to complete the statistical calculations. Descriptive statistics and a simple linear regression were calculated.

Findings

Simple Linear Regression Analysis (SLR) Research Question: Does the STAR math test have predictive value for algebra I End of Course scores?

Table 1: Regression Analysis for STAR math score vs. Algebra 1

EOC Scores

Model: $EOC = 0.053 \text{ STAR math} + -17.7509 \text{ CNST}$

Source	Beta Coef.	R ²	SEE	F	p-value
Constant	-17.751				
STAR MATH	0.053	0.50	3.39	198.26	1.07E-31

Alpha = 0.25

Table 1 shows the results of a simple linear regression done to determine if the EOC score for algebra 1 can be predicted from the STAR math test score. The beta coefficient for the constant is -17.751 and for the STAR math test score was 0.053. This shows that the EOC score increases 0.053 points for every increase of one point on the STAR math test score. The R² value of 0.50 means that this simple linear regression accounts for 50% of the variance. The standard estimate of error (SEE) of 3.39 means that this simple linear regression is accurate at + or – 3.39 points at one standard deviation. Both of these are moderately strong indicators of strength. The F value of 198.26 is moderately high compared to 0 and the p-value of 1.07E-31 means that there is hardly any chance of a type 1 error occurring.

The null hypothesis for this simple linear regression is that the STAR math test score cannot predict algebra 1 EOC scores. Based on the above information and since the p-value of $1.07E-31$ is below our alpha level of 0.25 the null must be rejected meaning that algebra 1 EOC scores can be predicted from STAR math test scores.

Conditions: Confidence Limits = 95

Value for STAR math test score = 800.5

Forecast = 24.38

Lower = 17.67

Upper = 31.09

The above information means that if a student scores a 800.5 on the STAR math test their forecasted score on the algebra 1 EOC would be a 24.38 but could be as low as 17.67 or as high as 31.09.

Conclusions and Recommendations

This study shows that there is validity to using STAR math test scores as a predictor of how students will perform on the algebra 1 End of Course exam. Because of this, the conclusion can be drawn that teachers of incoming freshman could use their student's eighth grade STAR math scores to determine what interventions and support, if any, the student may need. It should be noted that simply because a student does not perform well on the STAR math test does that necessarily mean they are in need of extra help. There will always be students that are not very good test takers, were sick the day they took it or, just didn't put forth the effort on the STAR math test. Some of those things, such as test taking strategies and working on test endurance for other tests such as the ACT could also be worked on during intervention time.

Another limiting factor of this study is that it only included data from one Missouri high school. The outcome could be different for schools with a different make up and background than the school in this study. Also, at the time of this study AYP is partially based on algebra 1 EOC scores. With education being an ever evolving entity, the weight of that particular test may lessen but the practice of identify students in need of assistance and trying to get them all the help they may need will still be present.

For future researchers, the recommendation could be made to get a sample from a variety of schools to give the study more weight. Also, it is necessary to not only find a predictor but also find one that is very reliable. If further research were to be done, other variables could also be tested such as eighth grade MAP scores or benchmarks created of items released by the state. Then a multiple stepwise regression analysis could be done to

determine not only if one is a predictor of EOC scores but also which is the better predictor.

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