Target Scores on Northwest Evaluation Association Assessments that Predict Success on the Minnesota Comprehensive Assessments - II: Results from a TIES-wide Study

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April, 2008

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Introduction

The use of assessment data to examine and make decisions about student performance is increasingly becoming the norm in schools across the United States. A variety of policy changes have certainly been a catalyst for the data-based decision making movement, the most visible of which is No Child Left Behind (NCLB, 2001). However, given the degree to which using data to support daily decision making practices has become a part of the culture of so many schools, it seems likely that this data use will remain long after the next wave of changes arrive in the public policy arena. Simply put, using data to support decision-making processes in education is here to stay.

One major reason for this cultural shift in education is the value that the use of assessment data brings to schools (Boudette, City, & Murnane, 2005). Research has begun to examine this value, and explore ways to improve upon it. One specific concern that has arisen in many schools is the overwhelming amount of data. For example, a school may now use several different assessments to examine student performance throughout the school year. Each of these assessments may present scores in completely different formats – some assessments report scale scores, others provide a RIT score, and some simply provide a raw score. Additionally, results may also be presented by way of comparison to a "norm" group, a group of similar children who have also taken the assessment. However, this norm group is also likely to vary, both in scope and quality. Some assessments may provide results relative to a national norm, some relative to a "user norm", others are only normed locally.

When faced with making an instructional decision about a student, the number of variables an educator must weigh seems to have grown exponentially. Many teachers and administrators do not have the training necessary to properly understand and weigh each of these different assessments (Schmoker, 1996). Yet, best practice suggests that multiple sources of data should be reviewed, in order to gain a full and accurate picture of student performance, a concept sometimes referred to as triangulation (Campbell and Fiske, 1959). Triangulation is made more difficult by the inconsistent manner in which assessment data are presented. In practice, this often leads to a process that may be better known as "Triangulation in isolation". Many sources of data are available, but only one is really being examined for any given educational decision (and which one may vary by the type of decision being made).

Target scores are a solution to the problem of triangulation in isolation. Target scores take each of the different assessments that a school may be using, and provide a consistent format of presentation. Scale scores, raw scores, etc., are all simply presented relative to their respective targets – students are well above target, above target, below target, etc., on each measure. In addition to format of presentation, the decision-making process related to each assessment is identical: students are compared to a set of target scores, their performance is categorized relative to those targets, and instructional changes are applied based on students' performance. This allows educators to quickly and easily understand, compare, and synthesize student performance information across a variety of assessments.

In order to have consistent target scores to support this efficient decision-making process, the targets must first be established using a consistent method across assessments. The primary goal of creating target scores is to determine whether or not a student is "on-track". In this study,

"on-track" refers to whether student progress in reading and mathematics achievement is adequate. In each state, the definition of "adequate" has been established through the development of state standards, and statewide assessments to establish student performance relative to those standards. The question then becomes, what level of performance on local assessments is equivalent to success on state standards? And, furthermore, what level of performance on local assessments will predict successful performance on later statewide assessments? A system of target scores where all local assessments are linked to a common outcome (success on statewide assessments) provides a consistent set of benchmarks for student performance across measures and across time.

This consistent measurement system is essential for decision-making. Systems such as Response to Intervention rely on consistent benchmarks of student performance, as well as measures that can sensitively measure student progress toward those benchmarks (Bollman, Silberglitt, & Gibbons, 2007; Gibbons & Silberglitt, 2008). This study provides a step forward for schools, by demonstrating a process for developing these benchmarks on a commonly-used assessment, with a broad sample of students from Minnesota.

Methods

Participants

The sample consisted of 98,551 students from 30 school districts in Minnesota. These districts were either members of TIES or otherwise using TIES technology tools to store and report assessment data. These districts gave permission for TIES to analyze their students' Northwest Evaluation Association (NWEA) tests (i.e., MAP, NALT, CALT) and Minnesota Comprehensive Assessments (MCA-II), to better understand the relationship between NWEA and the statewide assessments at the individual student level.

Participating students were 49% male and 51% female. Ethnicity breakdown was 88% White, not Hispanic; 9% Black, not Hispanic; 5% Hispanic; 7% Asian or Pacific Islander; and 1% Native American. Students labeled Limited English Proficient represented 6% of the sample, and, while data on economic aid was only available for 92% of the sample, of those students 24% qualified to receive free or reduced price lunch.

Data Analysis Plan

Data from NWEA and statewide assessments were analyzed using Logistic Regression. Previous research comparing statistical analysis methods for developing target scores established Logistic Regression as an especially advantageous approach (Silberglitt & Hintze, 2005). Logistic regression (LR) is a regression analysis procedure used when the dependent variable is categorical. With LR, either continuous or categorical independent variables are used to determine probabilities of membership in each of the categories of the dependent variable, using maximum likelihood estimation (Neter, Kutner, Nachtsheim, & Wasserman, 1996). LR calculates the probability (zero to 100%) that a person is a member of a group.

In this study, the dependent variable was the result on the statewide assessment, whose categories were "at or above grade-level proficiency" and "below grade level proficiency", and the independent variable was the score on the NWEA assessment. LR has been frequently used in epidemiology for similar situations, using continuous variables to predict the incidence or absence of disease (Rothman, 2002). Furthermore, LR is considered a superior alternative to

other statistical methods, such as Discriminant Analysis, when the assumptions of multivariate normality are not met (Press & Wilson, 1978).

This study was designed to improve upon an existing study done by the Northwest Evaluation Association (Cronin, 2007), in three important ways. First, the previous NWEA study analyzed data only at the school level. The study looked at the percent of students at a given school who performed above grade level standards on the statewide assessment, and then found the equivalent local percentile on the corresponding NWEA assessment. The NWEA study was not able to ensure that the identical student populations were represented in both groups (i.e., mobility factors), and did not examine whether students above grade level standards on the statewide assessment were in fact the same students who performed in the higher ranges on the NWEA assessment. The current study examined the relationship between these two tests at the individual student level, directly correlating performance for each individual student on each of the two assessments, and establishing target scores based on this relationship.

Second, the NWEA study was only able to establish target scores for spring tests, as they were given at the same time as the statewide assessment. The current study establishes target scores for both fall and spring tests, and also for tests given in second grade. This provides target scores that predict later performance on state tests. These type of predictive targets are essential for tracking student progress toward a critical outcome, and for helping schools to better determine which students may be in need of early intervention.

Third and finally, the method used in the NWEA study generated target scores that cannot be adjusted. The current study uses a statistical technique known as logistic regression. A district advantage of this approach is that it provides flexibility in target setting; targets may be set in a way that further minimizes the number of students who are incorrectly predicted to be successful. These false negatives (a.k.a., “Unhappy Surprises”) arguably represent the worst possible type of prediction error schools can make, since these students are not indicated as needing additional support when this support may have led to those students’ reaching grade level standards.

Results

Descriptive Statistics

Results at each grade level and season of both the MCA-II and NWEA assessments were compiled. Descriptive statistics on these measures are presented in Tables 1 through 4. On both measures, results indicate approximately normal distributions, with low levels of skewness and kurtosis, with the MCA-II math at grade 8 being a notable exception. Sample sizes on NWEA assessments varied due to differences in district assessment schedules. Fall is defined as completing the assessment between the beginning of September and the end of October. Spring is defined as completing the assessment between the beginning of March and the end of May (within one to two months of the MCA-II assessments, given in late April or early May). MCA-II data were compiled across the 2005-06 and 2006-07 school years, the first two years of the revised version of this assessment. NWEA data were compiled across the 2003-04 through the 2006-07 school years, allowing for prediction forward (for example, from the Grade 2 NWEA to the Grade 4 MCA-II).

Correlations

Concurrent and predictive validity was examined by the correlations shown in Tables 5 and 6. Correlations were typically in the 0.7 to 0.9 range, with the highest correlations found in the later grades, in mathematics. Some decay was typical, with lower correlations when the time between the NWEA and MCA-II assessment was greater. Correlations indicate a strong concurrent and predictive relationship between the two assessments.

Table 1. Descriptive Statistics on the NWEA Math assessments, by grade level and season

	2 Fall	2 Spring	3 Fall	3 Spring	4 Fall	4 Spring	5 Fall	5 Spring	6 Fall	6 Spring	7 Fall	7 Spring	8 Fall	8 Spring
N	17292	23117	23836	33331	23129	33275	26697	33512	25372	35887	19758	27684	13928	21073
Mean	179.7	194	194.3	206.6	205.4	215.4	213.1	224.3	221.2	229.3	227	234.3	231.7	238.4
Median	180	195	195	207	206	216	213	225	222	230	228	235	233	240
Standard Deviation	11.9	12	12.1	12.5	12.4	13.7	13.5	15	14.1	15.8	15.3	16.5	15.9	16.7
Skewness	0.05	-0.18	-0.21	-0.27	-0.25	-0.24	-0.16	-0.32	-0.34	-0.4	-0.39	-0.53	-0.46	-0.56
Kurtosis	-0.07	0.3	0.37	0.82	0.81	0.44	0.41	0.36	0.56	0.35	0.61	0.49	0.38	0.59

Table 2. Descriptive Statistics on the MCA-II Math assessments, by grade level

	3	4	5	6	7	8
N	22236	22917	23326	23964	22623	20587
Mean	358.9	456.8	554.2	653.6	752.9	851.8
Median	359	457	555	654	754	853
Standard Deviation	12.2	13.8	15.1	15.2	15.2	14.7
Skewness	0.24	-0.02	-0.2	-0.31	-0.33	-1.3
Kurtosis	1.35	0.74	0.82	0.66	0.62	23.94

Table 3. Descriptive Statistics on the NWEA Reading assessments, by grade level and season

	2 Fall	2 Spring	3 Fall	3 Spring	4 Fall	4 Spring	5 Fall	5 Spring	6 Fall	6 Spring	7 Fall	7 Spring	8 Fall	8 Spring
N	17106	22943	23924	33506	23145	32780	23481	33262	24961	35942	22863	33062	18873	27922
Mean	175.8	191.1	190.9	201.8	200.9	208.7	207.9	214.7	213.8	219.1	217.7	222.8	221.2	225.6
Median	176	193	193	204	203	210	209	216	215	221	219	224	222	227
Standard Deviation	16.1	14.9	15.1	14.1	14	13.5	13.3	13	13.3	13.2	13.1	13	12.7	12.7
Skewness	0.02	-0.62	-0.56	-0.83	-0.79	-0.82	-0.85	-0.86	-0.83	-0.85	-0.88	-0.87	-0.91	-0.89
Kurtosis	-0.86	0.15	0.03	1.08	0.95	1.37	1.46	1.73	1.58	1.68	1.88	1.89	1.93	2.27

Table 4. Descriptive Statistics on the MCA-II Reading assessments, by grade level

	3	4	5	6	7	8
N	21652	22371	22865	23525	22259	20347
Mean	365.61	459.6	559.7	656.2	754.7	853.7
Median	365	459	559	657	756	855
Standard Deviation	18.8	15.7	14.5	13.5	14.4	13.9
Skewness	-0.4	-0.21	-0.18	-0.38	-0.29	-0.28
Kurtosis	0.21	0.69	0.75	1.01	0.68	0.66

Table 5. Correlations between the NWEA and MCA-II Math assessments.

		NWEA Assessments													
		2 Fall	2 Spring	3 Fall	3 Spring	4 Fall	4 Spring	5 Fall	5 Spring	6 Fall	6 Spring	7 Fall	7 Spring	8 Fall	8 Spring
MCA-II															
Grade 3	r	0.71	0.74	0.75	0.81										
	N	13166	17265	14198	20195										
Grade 4	r	0.66	0.69	0.72	0.77	0.77	0.83								
	N	9125	12694	11809	17524	12879	18987								
Grade 5	r			0.72	0.76	0.76	0.81	0.77	0.86						
	N			8992	12300	10422	16460	16159	19275						
Grade 6	r					0.76	0.80	0.76	0.84	0.85	0.88				
	N					9780	13601	13404	16505	15166	21015				
Grade 7	r							0.80	0.83	0.83	0.86	0.87	0.89		
	N							9875	13388	12097	18762	13939	19244		
Grade 8	r									0.77	0.81	0.81	0.84	0.85	0.86
	N									9625	14114	10245	16716	10446	16110

* - All correlations significant p<.01

Table 6. Correlations between the NWEA and MCA-II Reading assessments.

		NWEA Assessments													
		2 Fall	2 Spring	3 Fall	3 Spring	4 Fall	4 Spring	5 Fall	5 Spring	6 Fall	6 Spring	7 Fall	7 Spring	8 Fall	8 Spring
MCA-II															
Grade 3	r	0.70	0.76	0.78	0.81										
	N	12773	16992	13842	19664										
Grade 4	r	0.64	0.72	0.73	0.76	0.78	0.80								
	N	8941	12297	11411	17245	12545	18565								
Grade 5	r			0.70	0.73	0.73	0.76	0.77	0.80						
	N			9103	12349	10228	15944	12798	18668						
Grade 6	r					0.74	0.76	0.77	0.78	0.79	0.80				
	N					9531	12779	10309	16061	14763	20861				
Grade 7	r							0.75	0.75	0.77	0.77	0.80	0.79		
	N							9778	13241	11667	18735	13645	19024		
Grade 8	r									0.73	0.75	0.76	0.77	0.79	0.78
	N									9479	13975	9837	16571	10121	16569

* - All correlations significant p<.01

Logistic Regression

Comparing 2006 to 2007. Logistic Regression was used to examine the logistic response function for both predictive and concurrent relationships between the NWEA and MCA-II. First, a comparison of the concurrent relationships was conducted across school years of the MCA-II, in order to establish whether a consistent logistic response function was found across the 2006 and 2007 MCA-II tests. The logistic response functions to the 2006 and 2007 MCA-II Math tests are shown in Figure 1, and Reading is shown in Figure 2. In both cases, the curves are very similar, with little expected impact on target scores when comparing the two years. Based on these results, data across both school years of the MCA-II were compiled for all further analysis.

Comparing same-grade to next-grade. Next, logistic response functions were examined to determine whether similar target scores would be established if the NWEA was compared to the same-grade vs. next-grade MCA-II. For example, the grade 3 NWEA assessments were compared both to the grade 3 and grade 4 MCA-II. To determine the effect on target scores, a consistent P(success) of between 0.7 and 0.75 was used. An example logistic response function is presented in both math and reading in Figures 3 and 4, demonstrating the impact on target scores. In many cases, target scores set with comparisons to the same-grade MCA-II would be too low to expect a sufficiently high level of success on the next-grade MCA-II.

Figure 1. Comparing Logistic Response Functions for NWEA to 2006 vs. 2007 MCA-II, Math.

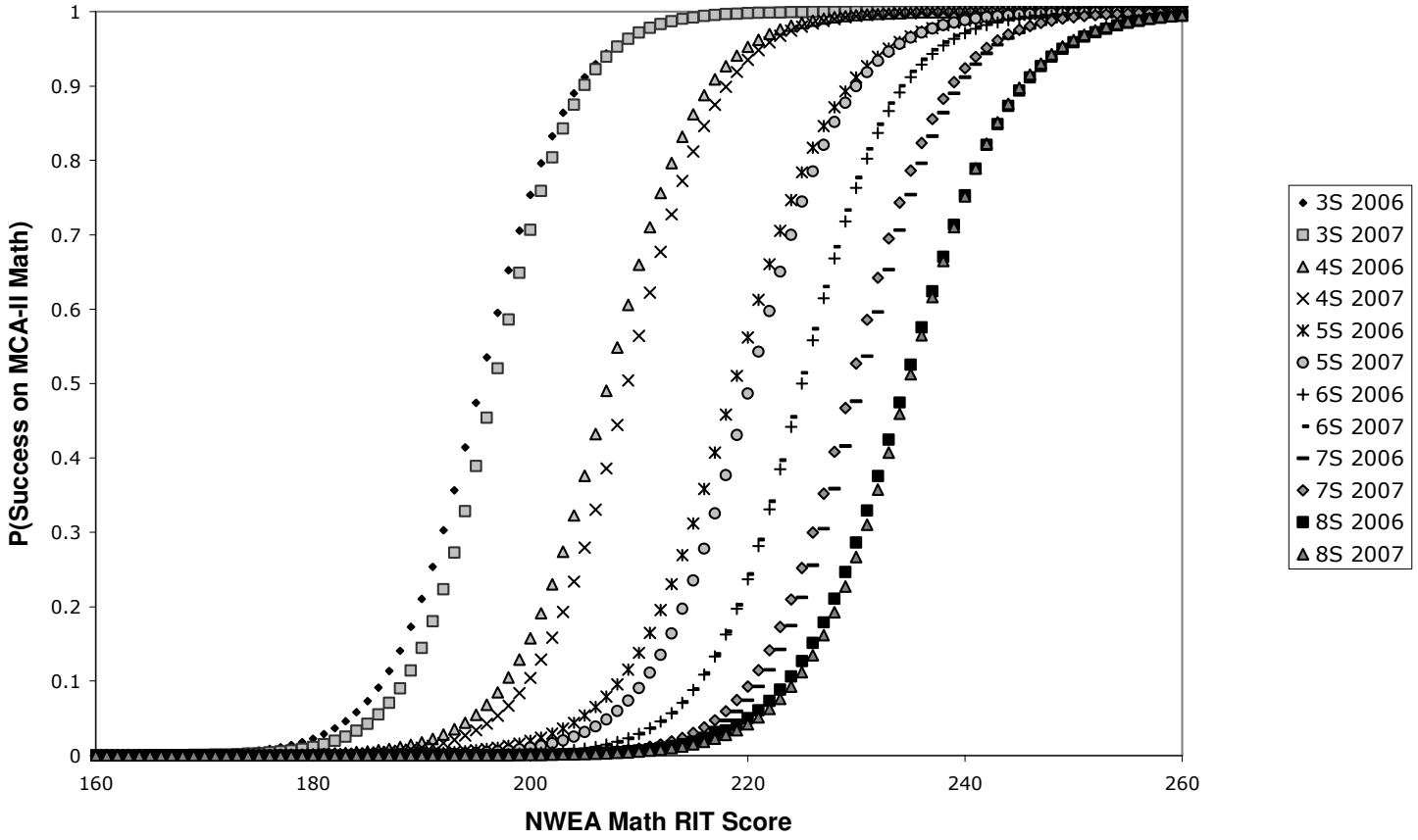


Figure 2. Comparing Logistic Response Functions for NWEA to 2006 vs. 2007 MCA-II, Reading.

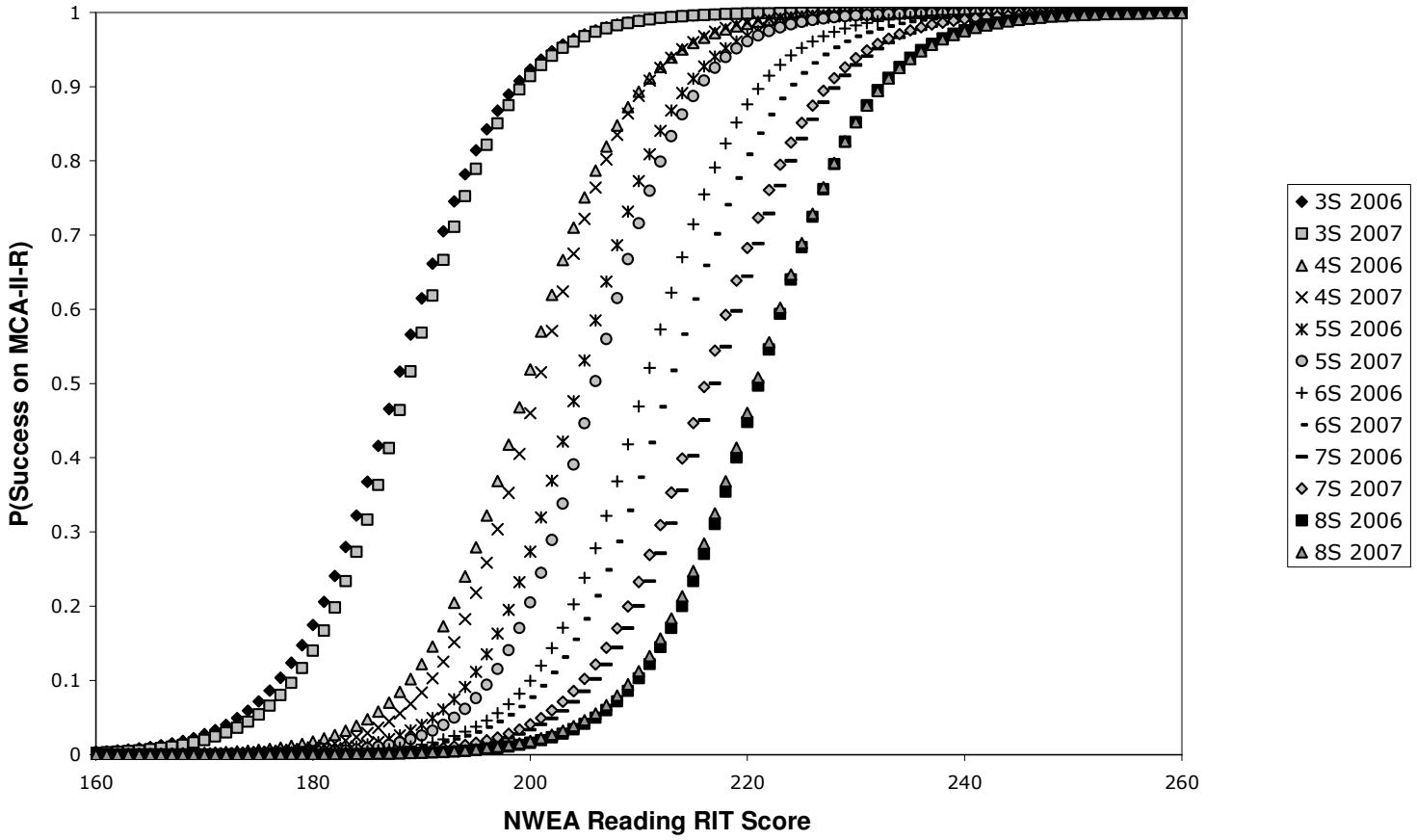


Figure 3. Comparing Logistic Response Functions, Grade 3 NWEA with Grade 3 vs. Grade 4 MCA-II Math.

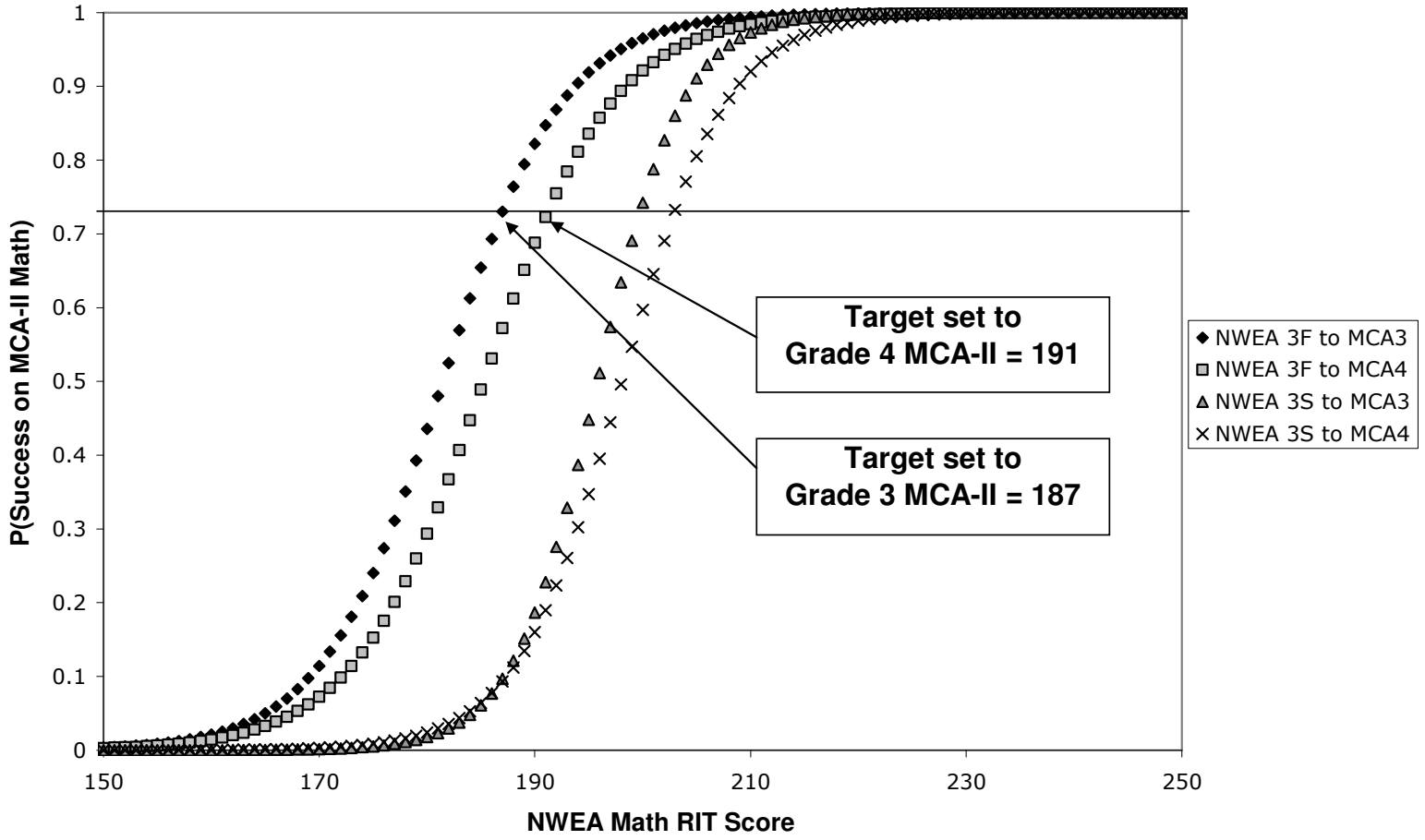
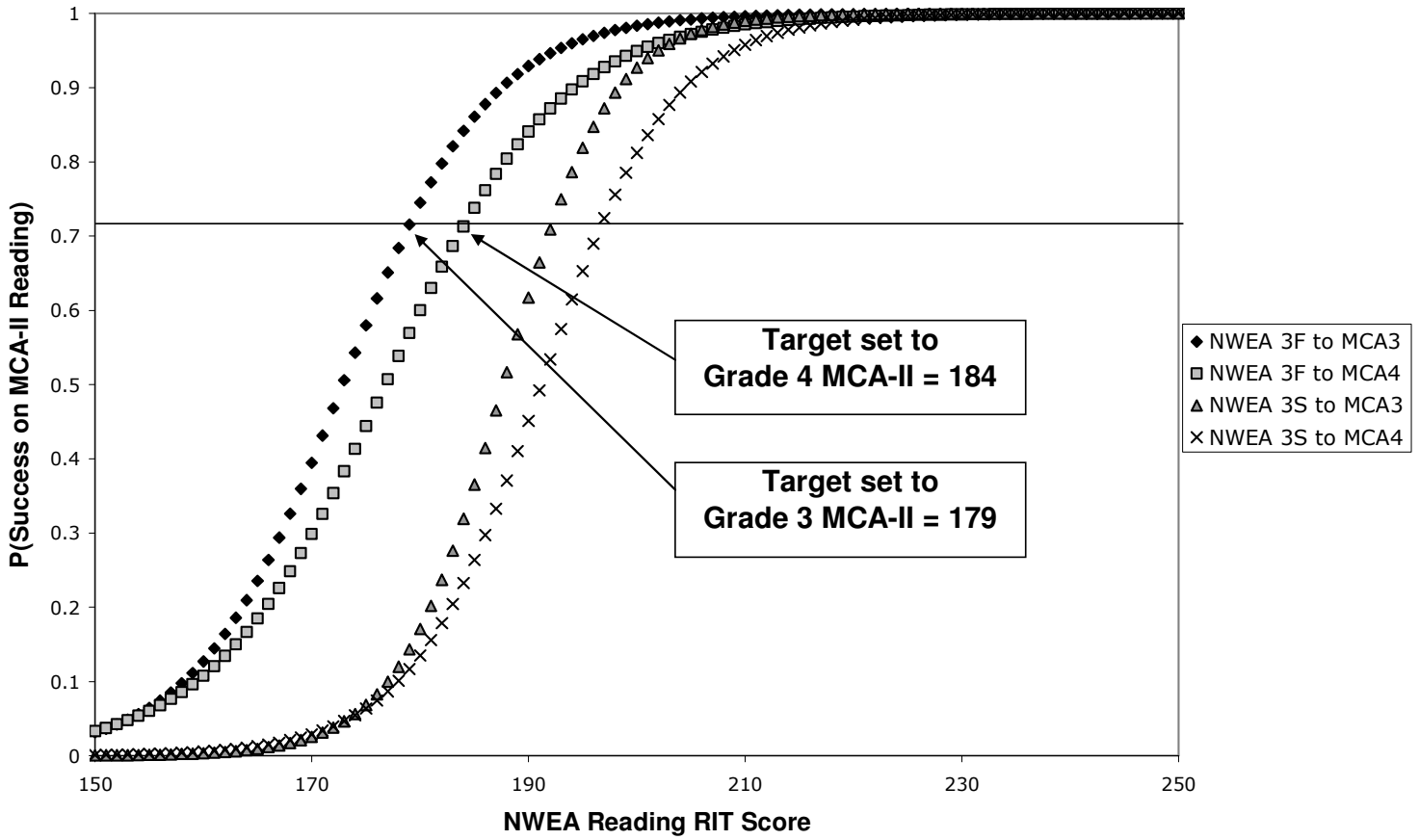


Figure 4. Comparing Logistic Response Functions, Grade 3 NWEA with Grade 3 vs. Grade 4 MCA-II Reading.



Final suggested target scores. It was assumed that errors where students are expected to succeed and do not should be considered more serious than errors where students are not expected to succeed and do. Based on this assumption, target scores were then set to whichever grade-level MCA-II yielded the highest target scores (either same-grade or next-grade). In all cases, a consistent P(success) of between 0.7 and 0.75 was used for the target. A second, Tier II target was also set, using a consistent P(success) of between 0.25 and 0.3. The final suggested target scores for both math and reading are given in the tables at the back of this document. Tier I represents that benchmark target, above which students are reasonably expected to succeed on the MCA-II. Tier II represents a lower-level target, useful for dividing students between those in need of Strategic and Intensive support in a Response to Intervention framework. The grade level MCA-II used to set the target score is noted at the bottom of each table.

Diagnostic accuracy statistics. Diagnostic accuracy indicators are also provided in these tables. Within each grade level, the top row presents the percentage of students at or above the Tier I target who were at or above grade-level standard on the corresponding MCA-II. Typically, this was around 90 percent. The middle row represents the percentage of students at or above the Tier II target but below the Tier I target who were at or above grade-level standard on the corresponding MCA-II. Typically, this was around 50 percent. The bottom row represents the percentage of students below the Tier II target who were *not* or above grade-level standard on the corresponding MCA-II. Typically, this was around 90 percent.

Conclusions

The goal of this study was to establish a set of target scores on NWEA assessments that predicted success on the MCA-II. A strong predictive and concurrent relationship was found between the two assessments, indicating that developing target scores would be appropriate. Data could be compiled across both the 2006 and 2007 MCA-II tests, due to the consistency in targets across both years. However, targets showed some sizable differences when comparing NWEA to the same-grade vs. next-grade MCA-II, with some differences representing as much as one-half year's growth. The goal of this study was to develop target scores that would be appropriate for use in schools. So, errors in prediction where students were expected to reach grade-level standards and did not were considered more serious that errors in prediction where students were not expected to reach grade-level standards and did. In all cases, the higher of the target scores was selected for a given grade level NWEA, either predicting to same-grade or next-grade MCA-II.

Target scores were developed using a methodology designed to establish the greatest possible consistency of targets. All targets were linked to a common outcome: success on the MCA-II. All targets were also linked using the same methodology, with the goal being to create similar levels of diagnostic accuracy across seasons and grade levels of the NWEA. This enables the user of the target scores to gain meaningful information from the targets. For example, if a student is below the grade 2 fall target and above the grade 2 spring target, it means they grew relatively quickly, and "caught up" to the pace of the increasing target scores over time. The student grew more than a year's growth in a year's time. This type of conclusion can be made without concern that it was the target score, not the student, which varied over time.

Similarly, these target scores can determine whether a group of students is improving, relative to targets. By examining the percent of students above target from season to season, one can determine the effectiveness of instruction for that group of students. A group of students where 50 percent are above target in the fall and 70 percent are above target in the spring have, as a group, demonstrated improvement that is faster than the pace of the increasing target scores.

The methodology in this paper can also be used to develop target scores for other measures, as well, with the added benefit of consistency across assessment types. For example, similarly developed target scores for Oral Reading Fluency would allow the user to determine whether a student was "on-track" across both Oral Reading Fluency and NWEA assessments.

Target scores are a valuable tool to support the data-based decision making process in schools. Initiatives such as Response to Intervention rely on a strong measurement system with reliable and consistent target scores across time, to establish "responsiveness" to instruction. When responsiveness is not occurring, instructional changes can be made in a timely manner. The ability for instruction to quickly adapt to changes in student performance is critical to successful outcomes for students.

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Linking NWEA to MCA-II: Results from a TIES-wide study

Math: NWEA (MAP) Target Scores

Grade		Fall	Spring		Fall	Spring
2	Tier I	176	190	Percent Successful at or above Tier I Target	89.9%	90.2%
	Tier II	164	179	Percent Successful at or above Tier II Target, but below Tier I Target	50.7%	51.5%
				Percent NOT Successful below Tier II Target	78.3%	82.4%
3	Tier I	191	203	Percent Successful at or above Tier I Target	90.5%	91.7%
	Tier II	180	194	Percent Successful at or above Tier II Target, but below Tier I Target	49.0%	48.6%
				Percent NOT Successful below Tier II Target	83.2%	86.2%
4	Tier I	205	214	Percent Successful at or above Tier I Target	88.8%	90.7%
	Tier II	196	205	Percent Successful at or above Tier II Target, but below Tier I Target	47.5%	48.5%
				Percent NOT Successful below Tier II Target	87.9%	89.3%
5	Tier I	213	222	Percent Successful at or above Tier I Target	89.4%	89.8%
	Tier II	202	215	Percent Successful at or above Tier II Target, but below Tier I Target	48.8%	41.9%
				Percent NOT Successful below Tier II Target	85.9%	91.1%
6	Tier I	221	227	Percent Successful at or above Tier I Target	90.8%	90.4%
	Tier II	213	221	Percent Successful at or above Tier II Target, but below Tier I Target	45.2%	41.3%
				Percent NOT Successful below Tier II Target	89.5%	91.9%
7	Tier I	227	233	Percent Successful at or above Tier I Target	91.8%	91.7%
	Tier II	219	227	Percent Successful at or above Tier II Target, but below Tier I Target	44.9%	45.3%
				Percent NOT Successful below Tier II Target	91.5%	91.9%
8	Tier I	233	238	Percent Successful at or above Tier I Target	90.5%	90.9%
	Tier II	224	231	Percent Successful at or above Tier II Target, but below Tier I Target	47.4%	47.3%
				Percent NOT Successful below Tier II Target	91.4%	91.5%

* - Grades 2&3 targets linked to grade 4 MCA-II, Grades 4&5 targets linked to grade 5 MCA-II, Grade 6&7&8 targets linked to same-grade MCA-II

Linking NWEA to MCA-II: Results from a TIES-wide study

Reading: NWEA (MAP) Target Scores

Grade		Fall	Spring		Fall	Spring
2	Tier I	167	184	Percent Successful at or above Tier I Target	90.5%	90.6%
	Tier II	149	169	Percent Successful at or above Tier II Target, but below Tier I Target	52.2%	50.0%
				Percent NOT Successful below Tier II Target	70.0%	82.0%
3	Tier I	184	197	Percent Successful at or above Tier I Target	91.6%	91.9%
	Tier II	170	186	Percent Successful at or above Tier II Target, but below Tier I Target	50.5%	48.0%
				Percent NOT Successful below Tier II Target	79.6%	85.0%
4	Tier I	196	204	Percent Successful at or above Tier I Target	92.1%	92.7%
	Tier II	185	196	Percent Successful at or above Tier II Target, but below Tier I Target	49.6%	49.0%
				Percent NOT Successful below Tier II Target	85.4%	89.2%
5	Tier I	205	212	Percent Successful at or above Tier I Target	90.6%	91.3%
	Tier II	196	203	Percent Successful at or above Tier II Target, but below Tier I Target	51.5%	51.8%
				Percent NOT Successful below Tier II Target	86.4%	87.7%
6	Tier I	212	217	Percent Successful at or above Tier I Target	89.3%	89.6%
	Tier II	202	208	Percent Successful at or above Tier II Target, but below Tier I Target	47.1%	48.2%
				Percent NOT Successful below Tier II Target	89.1%	89.0%
7	Tier I	218	222	Percent Successful at or above Tier I Target	89.1%	88.9%
	Tier II	208	213	Percent Successful at or above Tier II Target, but below Tier I Target	52.3%	49.8%
				Percent NOT Successful below Tier II Target	87.4%	88.0%
8	Tier I	222	225	Percent Successful at or above Tier I Target	89.5%	88.4%
	Tier II	213	216	Percent Successful at or above Tier II Target, but below Tier I Target	53.4%	49.8%
				Percent NOT Successful below Tier II Target	88.1%	90.1%

* - Grades 2-4 targets linked to grade 4 MCA-II, Grade 5 targets linked to grade 6 MCA-II
Grade 6 targets linked to grade 7 MCA-II, Grades 7&8 targets linked to grade 8 MCA-II