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ABSTRACT

In this study, special education teachers identified students with learning disabilities who were working on math skills usually taught two grades below the grade in which the student was enrolled. Each student (n=33) took two levels of the MAT/7 math computation test, an on-grade test, and an out-of-level test intended for students two grades below. All levels of the MAT/7 are statistically linked to permit scores comparisons across levels. On average, the students obtained a higher scale score on the on-grade test (mean=557) than on the out-of-level test (mean=541). When a correction was made for random guessing, the mean scale score on the on-grade test (mean=535) was lower than the mean scale score on the out-of-level test (mean=550), although the difference was not statistically significant. More of the scores on the out-of-level test (n=16) fell in the tests reliable score range (45-75% correct) than did scores on the on-grade test (n=7). After completing each test, students were asked to rate how hard and how frustrating the test was for them. Ratings of test difficulty and frustration did not differ for the out-of-level and in-level tests. Generally, the students rated both tests as being fairly easy. (Contains 10 references.) (CR)

Out-of-Level Testing Report 8

Scale Score Comparability Across Two Levels of a Norm-Referenced Math Computation Test for Students with Learning Disabilities

NATIONAL CENTER ON EDUCATIONAL OUTCOMES

In collaboration with:

Council of Chief State School Officers (CCSSO)

National Association of State Directors of Special Education (NASDSE)

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Executive Summary

Out-of-level testing is the practice of giving students a test intended for students in a lower (or higher) grade. Fourteen states currently permit out-of-level testing in their statewide testing programs. This number has risen dramatically since 1999, despite growing concern about the implications for students who take an out-of-level test instead of the on-grade level test. Among the concerns are the possibility that: (a) the out-of-level test may not represent a sound measure of performance against state standards, (b) out-of-level testing may result in lowered expectations, and (c) the score a student receives on the out-of-level test may not be comparable to the score the student would have obtained on the in-level test. The present study addresses the third concern using a norm-referenced test and does not address the first two concerns.

In this study, special education teachers identified students with learning disabilities who were working on math skills usually taught two grades prior to the grade in which the student was enrolled. Each student took two levels of the MAT/7 math computation test, an on-grade test and an out-of-level test intended for students two grades below the grade in which the students in this study were enrolled. All levels of the MAT/7 are statistically linked to permit score comparisons across levels.

On average, the students in this study obtained a higher scale score on the on-grade test (mean = 557) than on the out-of-level test (mean = 541). When we made a correction for random guessing, the mean scale score on the on-grade test (mean = 535) was lower than the mean scale score on the out-of-level test (mean = 550), although the difference was not statistically significant. More of the scores on the out-of-level test (N = 16) fell in the test's reliable score range (45%-75% correct) than did scores on the on-grade test (N=7).

After completing each test, we asked the students to rate how hard and how frustrating the test was for them. Ratings of test difficulty and frustration did not differ for the out-of-level and in-level tests. Generally, the students rated both tests as being fairly easy.

Two preliminary conclusions can be drawn from this study. First, it appears that the on-grade test was too difficult for many of these students. This suggests that these students probably had less exposure to the kinds of skills assessed on the on-grade test than on the out-of-level test. The higher average scale score for the on-level test compared to the out-of-level test probably was related to the occurrence of guessing. Students appeared to guess more on the on-grade level test than on the out-of-level test, even though we had instructed them to skip questions they did not understand. A second preliminary conclusion is that performance on the out-of-level test appeared more often to be within the reliable range of the test. These conclusions are considered preliminary because of the small number of students in the study, complicated by the fact that to adjust for guessing we had to exclude more than half of the sudents from our analyses. Also, preliminary conclusions apply only to norm-referenced tests that are vertically linked across levels.

It is important to pay attention to the suggestion that students may have had less exposure to the skills assessed on the on-grade test. As standards-based reform is fully implemented, the issue of students not having exposure to grade-level content will need to be examined. One possible concern is that students who fall behind are then provided remedial instruction that limits their access to grade level content. Methods used to support students who are struggling may need to change so that fewer students are missing essential grade level content.

Overview

Prior to the 1994 reauthorization of the Elementary and Secondary Education Act (ESEA), the effectiveness of Title I programs was determined by performance gains from fall to spring testing. Growth generally was measured with off-the-shelf norm-referenced tests. In order to show growth, it was deemed important to measure students as closely as possible to the grade level of the content on which they were being instructed. For many students, the test they took was intended to measure skills taught in a grade below the student's actual grade. This practice of administering a level of a test to a student that is below the level (or above the level) generally recommended by the test publisher for that student based on his or her grade is called out-of-level testing (Study Group on Alternate Assessment, 1999, p. 20).

The reauthorization of ESEA in 1994 shifted the focus of program effectiveness from achievement score gains to performance against standards. Under the reauthorization, states were required to create academic standards and develop tests that were aligned specifically to those standards. Student performance was to be reported as a proficiency level, not just a test score, and states were required to report results for students with disabilities both in the aggregate as well as disaggregated. From these requirements emerged statewide testing programs in which assessments were designed to measure student performance on the state's standards. To date, results from these new standards-based assessments show that students with disabilities are much more likely than their peers without disabilities to perform below the state proficiency level (Ysseldyke, Thurlow, Langenfeld, Nelson, Teelucksingh, & Seyfarth, 1998). Furthermore, this finding has remained steady across years. States have seen relatively small changes in the proportion of students with disabilities scoring above proficiency. This has led to a growing concern that the tests are not sensitive to performance gains in the lowest proficiency levels. In response to this and other concerns, several states have decided to allow out-of-level testing (Minnema, Thurlow, & Scott, 2001). The rationale for incorporating an out-of-level testing option in a state assessment program seems to be that out-of-level testing will improve the accuracy of measurement for low performing students and, thus, may also improve the sensitivity of tests to performance gains.

Several issues emerge with the practice of out-of-level testing. One is the possibility that out-of-level testing will result in lower expectations for students. Another is the likelihood that testing conditions may be more chaotic with groups of students taking a wide array of different tests at the same time. There is also concern that nearly all students with disabilities will be assigned to lower levels of the test even when prior achievement indicates that they should receive a higher level.

An emerging question is whether the scores from an out-of-level test have the same meaning as the scores from the in-level test. Test score comparability is an essential component of any large-scale assessment program. At a minimum, out-of-level tests must be linked to the in-level test, ideally with a high degree of overlap between the out-of-level and the in-level test of concepts and skills, as well as the actual test items. Linking studies should include a high percentage of students from the populations likely to take the out-of-level test, such as students with disabilities; otherwise, it may not be appropriate to generalize the adequacy of the vertical scaling to students from these populations.

States that allow out-of-level testing generally have not conducted linking studies. Often, they rely on the test developer to provide the rationale for out-of-level testing. In those states where an off-the-shelf test is used, they rely on the linking studies conducted by the test publisher during the national norming phase of test development. Many other states incorporate a set of normed items into their standards-based assessments, and thus – hypothetically – might use those links to apply to their tests so that scores from all levels can be reported on a common scale. One of the shortcomings of relying on the linking studies conducted by commercial test developers is that students with disabilities comprise only a small fraction of the participants in these studies (Harcourt Brace Educational Measurement, 1997). Therefore, the adequacy of the linking studies for students with disabilities is not completely known. It is necessary to demonstrate scale score comparability across test levels for students with disabilities, especially because it is likely that many students with disabilities would be assigned to an out-of-level test.

Scale Score Comparability

Theoretically, when tests are vertically scaled so that a single score scale spans the range of test levels, an examinee should obtain the same scale score regardless of the level of the test he or she takes. If an examinee obtained a scale score of 150 on the Level 3 test, he or she should also obtain a scale score of 150 on Level 5. There are several conditions limiting the comparability of the scores. Some conditions can be manipulated by the test developer. For instance, the test developer can ensure that there is a high degree of overlap of test items between adjacent levels. The test developer can also employ the best statistical methods for linking tests, and the developer can ensure adequate sampling of students in the linking study for best results. Regardless of the procedures the test developer employs, the assessments will still be imperfect measures of the constructs. In other words, every examinee's score will contain error, called measurement error. Therefore, the best one can expect is that the scores an examinee obtains from different levels of the test will fall within some range determined by the magnitude of the measurement error. Scale scores can be considered comparable if the two scores fall within the range bounded by one unit of measurement error. As an example consider a test in which the average measurement error is 10 scale score points. If an examinee obtains a score of 100 on Level 5, then the score the examinee obtained on another test would be comparable if it fell within the range 100 + 10 (i.e., 90 – 110).

In addition to measurement error, guessing can influence the degree of scale score comparability across levels. Unlike measurement error, which is considered random, guessing has a tendency to bias scores upward. When a student takes a multiple-choice test, there is the possibility that some of the correct responses were obtained by simple guessing. Guessing poses a problem because examinees may be more likely to guess on the harder test than on the easier test. It is easy to see why this is likely to be true. If a test is too hard for an examinee as indicated by getting very few items correct, it is likely that he or she does not have the skills to answer many of the items. If the examinee attempts to answer the items he or she does not know how to do, then he or she must be guessing. Guessing on more of the items on the hard test than on the easy test would have the effect of increasing the difference between the scale scores. Because the goal of this study was to evaluate scale score comparability across two levels of a test, this study reports results with and without a correction for guessing.

A question that often emerges is, "why give an out-of-level test if the score would be the same as the score on the in-level test?" Several reasons may be offered, but the reason that is most relevant to the present study is that performance on an out-of-level test for a student who would otherwise get very few items correct on the in-level test is a more reliable and accurate estimate of the student's ability. The explanation for this lies in the fact that measurement error increases at the test score extremes. Most off-the-shelf tests are designed so that test performance is most reliably measured for examinees getting between 40% and 70% correct. Outside of this range, the reliability of the score decreases as the score moves farther from this range. Very low scores, say less than 25% correct are so contaminated with measurement error that it is nearly impossible to say with any degree of confidence what the student's true ability is. One purpose of out-of-level testing is to ensure that the test is matched to the student's ability so that performance falls within the range that scores are reliably estimated. If the purpose of administering the test is to obtain a score, rather than just to indicate whether or not the student has met a specific proficiency criterion, this is very important.

Prior Research on Score Comparability

There is a small research base on score comparability of out-of-level versus in-level test performance (Cleland & Idstein, 1980; Long, Schraffran, & Kellogg, 1977; Slaughter & Gallas, 1978). Cleland and Idstein examined scale score comparability on students with disabilities. In that study, test performance was measured on the normal curve equivalent scale. Seventy-four 6th grade special education students took two levels of the 1977 edition of the California Achievement Test. One group took the in-level test and the test one level below, another group took the in-level test and the test two levels below, and the third group took the test one-level below and the test two levels below grade level. They found that the average normal curve equivalent score was significantly higher on the in-level reading test than on either of the out-of-level reading tests. In mathematics, they found a significant difference only between the in-level test and the test two levels below grade level. They also found that a significantly greater percentage of the students scored above the floor level on the out-of-level test of reading than on the in-level test of reading; the difference was not statistically significant on the math test. The authors concluded that the possible detrimental effects of depressed scores on self-concept and the political ramifications of lower scores may outweigh any benefit of out-of-level testing.

Cleland and Idstein (1980) did not consider the issue of which score was a more valid representation of what the students knew and could do. Because the validity of a multiple-choice test score is compromised by the presence of random guessing, the effects of guessing were likely to be larger for the students taking a test that was too hard for them than they are for students taking a test that matches their ability. It is important to ask whether the scale scores remain statistically lower on the out-of-level test if random guessing is factored out of both the in-level test and the out-of-level test.

Long, Schaffran, and Kellogg (1977) compared grade-equivalent scores for students participating in a Title I reading program. The sample of 482 students included children in grades 2-6. Each student took two levels of the Gates MacGinitie Reading Test, one level corresponding to his or her grade level and the other corresponding to his or her "functional" level. A student's functional level was determined by his or her score on the Botel Word Opposites Test. The findings of Long et al. painted a mixed picture of score comparability across levels. For students in 2nd and 3rd grade, the functional level test resulted in significantly higher grade equivalent scores, but for students in grades 4, 5, and 6, the functional level test resulted in significantly lower grade equivalent scores. The study also found that achievement gains were consistently larger for all grade levels on the functional level tests than on the grade level tests. It is worth noting that although Long et al. made no attempt to adjust for guessing in their analyses, even though they acknowledged that one of the issues spurring the use of out-of-level testing was the concern that in-level scores for low achieving students were contaminated by guessing.

A score comparability study by Slaughter and Gallas (1978) also found a significant difference in scale scores between the in-level test and a test two levels below grade level. In that study, they gave both an in-level and an out-of-level test to 101 6th graders enrolled in a Title I school. They reported that 73% of the students in their study performed in the reliable range of the test, defined as a raw score between 25% and 75% correct. On the surface, these results appear to corroborate the results of the studies summarized above. However, these results better demonstrate why it is problematic to base assignment to out-of-level tests on a student characteristic such as being enrolled in a Title I school as opposed to using prior performance or instructional level to assign students to an out-of-level test. The fact that 80% of the students scored above the floor on the in-level test suggests that many of these students should not be taking an out-of-level test in the first place. Although some school systems may have a practice of giving all Title I students or all special education students an out-of-level test, this practice is *not* recommended by the test publishers.

Prior research on scale score comparability across test levels for students with disabilities lacks two important characteristics: (1) participants were not appropriately identified as candidates for out-of-level testing, and (2) there was no adjustment for random guessing. The participants in the Cleland and Idstein study (1980) were chosen without regard to whether they actually were appropriate candidates for out-of-level testing. Many students with disabilities may be performing at a level for which out-of-level testing would not be justified. Assurance that results can be generalized to the population of students who may be appropriate candidates for out-of-level testing requires that studies draw participants from such samples. Appropriate assignment to an out-of-level test requires knowledge of the level of instruction and performance in the classroom. Locator tests may be good proxies for this information; whether they are requires further study.

The other shortcoming of prior studies on out-of-level testing is that there was no accounting for the effects of random guessing. The presence of guessing reduces the accuracy of performance estimates, and thereby also reduces the validity of inferences from those scores. Observing significantly higher scores on an in-level test does not necessarily mean that the out-of-level test is biased against the participants; instead it may be that the in-level scores were biased because more random guessing is likely to occur when the test is too hard for the examinee. An assumption that can be made is that an examinee is probably guessing if he or she does not skip items for which he or she does *not* know the correct answer. Simple formula scoring methods can be applied to both the in-level and out-of-level item responses to adjust for the effects of random guessing.

The present study avoids the two major pitfalls of previous studies. First, we used a specific method to obtain a sample of students with disabilities for whom an out-of-level test seems to be warranted. Second, we conducted scale score comparability analyses on both the observed scale score and on a scale score adjusted for random guessing.

It is important to remember that we conducted our study using a norm-referenced test with vertical linking across levels. The findings do not answer questions about out-of-level testing when criterion-referenced tests without vertically-linked levels are being used.

Research Questions

In this study we explore scale score comparability across two levels of an off-the-shelf math computation test for students with learning disabilities. We examine three research questions:

(1) Will the average scale score on the in-level test be the same as the average scale score on the out-of-level test?

(2) Will the average scale score on the in-level test and the out-of-level test, after adjusting both sets of scores for random guessing, be the same?

(3) Will students rate their test experience as more positive on the out-of-level test than on the in-level test?

Method

Participants

A pool of potential participants was identified by special education teachers from five elementary schools in an urban school district. To be eligible for participation in the study, the students had to be:

- enrolled in either 5th or 6th grade
- working on math skills more typical of the curriculum two grades below the student's nominal grade level – based on the judgments of students' special education teachers
- receiving Level III or Level IV special education services, a moderate level of support in a system with levels I (consultation) to VI (residential placement).
- classified as having a learning disability
- able to read and comprehend simple sentences – based on teacher judgment

Most of the students were receiving math instruction in a self-contained classroom, separate from their in-grade level peers. A few participants were receiving instruction at grade level, but were also receiving remedial instruction on content and skills more typical of the curriculum two grades below their assigned grade level. Parental consent to participate was obtained from 34 students; 33 students actually participated in the study. Ten (30%) of the participants were female, and 16 (48%) were in the 5th grade.

Instruments

The Math Procedures subtest of the Metropolitan Achievement Test/7 (MAT7) was used in this study. The MAT7 was chosen for several reasons. First, the levels of the test are vertically scaled so that performance on any one of them can be reported on a common scale. Second, 50% of the items on these tests are computation items, and the other 50% are simple word problems. Choosing a math computation test reduces the concern of interference due to verbal complexity. This is particularly important because many of the students in this study were not reading at grade level. Third, these tests are used in the school district from which these participants were chosen.

Four levels of the test were used: Elementary 1, Elementary 2, Intermediate 1, and Intermediate 2. Each test had 24 multiple-choice items, 12 of the items were simple word problems and the remaining items were straight computation problems. The Elementary 1 test contained single-digit, two-digit, and three-digit integer addition and subtraction, mixed-digit multiplication, and division in which one of the numbers was a single digit. The Elementary 2 test had fewer single-digit whole number addition and subtraction items, and more addition items with decimals. It also had two addition/subtraction items involving fractions with a common denominator. The Intermediate 1 test adds to these skills division with two-digit divisors and quotients with remainders, as well as addition with fractions that requires finding a common denominator. The Intermediate 2 test adds more problems with fractions and decimals. The 5th grade participants took the Elementary 1 and Intermediate 1 tests, whereas the 6th grade participants took the Elementary 2 and Intermediate 2 tests.

Students also completed a brief survey after completing each test. The five questions in the survey are included in Appendix A. Participants were asked to rate the difficulty of the test, their degree of frustration, and how many items they did not know how to do. Participants were also asked specifically whether the word problems were hard and whether they found it hard to understand what the word problems were asking. These questions were included because teachers informed us that although many students could do the computation and could read basic text, they probably would struggle with the word problems.

Procedures

Testing was conducted at five schools with groups ranging from as few as four participants to as many as 14. The participants were assembled into a self-contained classroom. Each student was given a test packet that contained two levels of the Math Procedures test and two follow-up surveys. Tests were placed in packets so that the order of administration, in-level and out-of-level, was counterbalanced.

Prior to beginning the test, the proctor briefed students on the instructions for taking the test. The instructions generally followed those found in the test manual (Psychological Corporation, 1993). There were two principal differences in our instructions for this study. First, students were instructed to provide their answer in the test booklet instead of on a bubble sheet. It was hoped that this would minimize recording mistakes. Second, students were told to skip the items they did not know how to do. The instructions read as follows:

Read each question and choose the best answer. Then, mark the space for the answer you have chosen. If you do not know how to do the problem, leave it blank and go on to the next question. If you are pretty sure how to do the problem, then mark the choice you think is best.

These directions were intended to limit random guessing, while encouraging participants to make educated guesses when necessary. Participants were given as much time as they needed to complete the test. After all students completed the test, they were instructed to place the test back into their folders and to take out the first follow-up survey. Test booklets and surveys were color coded so that the results of the survey could be matched to the results of the test. The proctor read the survey questions and response options to the participants. After the survey was completed, the procedures were repeated for the second test.

Analysis

The study was designed to examine whether the scale score an examinee obtains on the out-of-level test would be comparable to the score he or she obtains on the in-level test. Scale score comparability was analyzed two ways. First, we compared the mean scale score on the in-level and out-of-level test using a paired t-test. Second, we examined the number of students for whom the in-level test score fell outside of the 95% confidence interval of their out-of-level test score. A 95% confidence interval on an individual test score represents the range within which the person's true score likely falls. It accounts for the presence of measurement error in the test – the smaller this interval, the more reliably performance is estimated. The lower bound of the 95% confidence interval is calculated by subtracting from the observed score the value of two times the standard error of measurement; the upper bound is calculated by adding to the observed score the value of two times the standard error of measurement. For instance, if an individual's observed score was 100, and the standard error of measurement for that test was 15, then the 95% confidence interval would range from 70 to 130. The reason for looking at the result this way is that the paired t-test, as with all hypothesis testing, does not account for measurement error, and the probability of detecting a statistically significant finding is a function of sample size. The second method is not affected by sample size and it accounts for measurement error. Because a 95% confidence interval is used, one would expect that 5% of the examinee scores (N=2) should fall outside this interval by chance.

The Multilevel Norms Book (Psychological Corporation, 1993) provides the standard error of measurement on the number-correct scale for the Math Procedures test. The standard error of measurement for the math procedures subtest was 2.06 for both the Elementary 1 and Elementary 2 levels. These values had to be translated onto the scale score metric because our comparison uses scale scores, not the number correct score. Using the raw score to scale score conversion tables, we determined that two points on the number correct scale translates to about 14 points on the scale score metric.

Controlling for Guessing

The methods for comparing scale scores described above also were conducted after making an adjustment on both the in-level and out-of-level tests for random guessing. A popular approach for correcting observed multiple-choice scores for the possibility of random guessing was described by Lord (1975). The method, called formula scoring is based on the following formula:

Adjusted Score (AS) = Original Score (OS) – Wrong Items (W)/(4-1)

AS represents the score adjusted for guessing; OS represents the original score obtained on the test; W represents the number of items answered incorrectly, and 4 indicates the number of alternatives for each item. It is evident from the equation that the correction applies only to the items for which the examinee gives an incorrect response. Items that the examinee skips are not included in the correction. The greater the number of items that an examinee attempts, but gets wrong, the greater the correction. When formula scoring is used, examinees are instructed NOT to guess on the items that they do not know how to do.

Results

Scale Score Comparability

Table 1 shows the mean percent correct by grade on the out-of-level test and the in-level test. The mean percent correct score for 5th graders on the out-of-level test was 48%, and .33% on the in-level test. The mean percent correct for 6th graders was 38% on the out-of-level test and 24% on the in-level test. The overall mean percent correct was 43% on the out-of-level test, and 28% on the in-level test. These findings seem consistent with what one would expect – that the mean percent correct would be higher on the out-of-level test because it is an easier test. However, it is inappropriate to compare performance across different levels of the tests this way (using percent correct) because these scores do not have the same meaning across different levels of the test. As indicated earlier, different levels of the test include different types of skills.

Table 1. Percent Correct by Level of Test and Grade

		Mean Percent Correct	
Grade	**N**	**In-Level Test**	**Out-of-Level Test**
5th grade	15	33	48
6th grade	18	24	38
Overall	**33**	**28**	**43**

The distribution of scores on the in-level and out-of-level tests is shown in Figures 1 and 2, respectively. The x-axis represents the range of scores on the percent correct metric, and each bar indicates the number of students scoring in that range. The two solid vertical lines represent the range in which measurement is most reliable. This range is bounded by 40% correct and 85% correct, which represent performance of one standard deviation below the mean and one standard deviation above the mean. Seven participants (21%) scored within this range on the in-level test compared to 16 participants (48%) on the out-of-level test.

Table 2 shows mean scale scores by grade and test level. The mean scale score was higher on the in-level test than on the out-of-level test for 5th graders, 555 vs. 536 for the in-level and out-of-level tests respectively. The scale score was also higher on the in-level test for 6th graders

Figure 1. Numbers of Students Scoring in Various Percent Correct Ranges on the In-Level Test

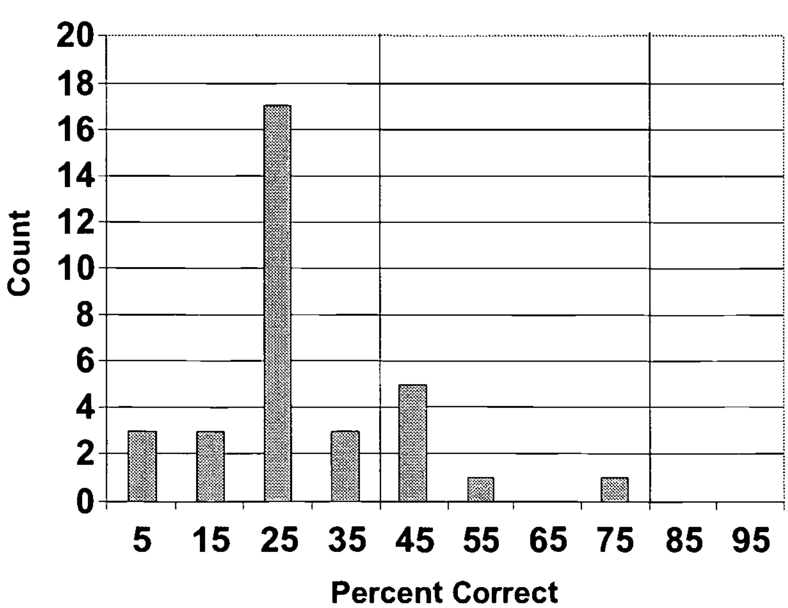
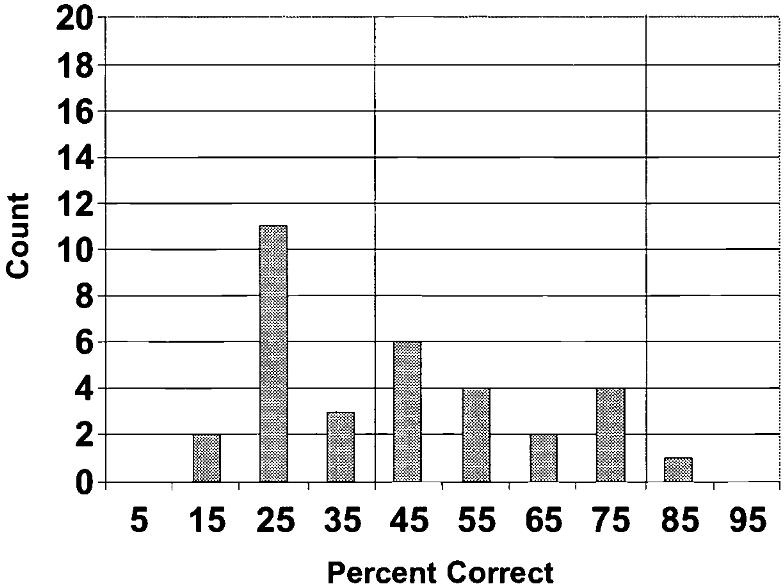


Figure 2. Numbers of Students Scoring in Various Percent Correct Ranges on the Out-of-Level Test



with 558 and 554 for the in-level and out-of-level tests respectively. A paired t-test compared the overall mean score on the in-level and out-of-level tests; this test of significance indicated that the mean scale score on the in-level test was significantly higher ($t = 3.3$; $p = .002$).

Table 3 shows the number of examinees whose in-level score fell outside the 95% confidence band on their out-of-level score. It is expected that two scores (5% of the cases) would fall outside of this band by chance. The results indicated the nine scores fell outside the interval, and that all of them fell above the upper bound. This is strong evidence that performance estimates from the in-level test are not comparable, and are substantially higher then the performance estimates from the out-of-level test.

Correction for Guessing

The adjusted number correct score was converted to a scale score using the conversion table provided in the manual. For some of the students, this score was less than or equal to zero, a situation that occurred when the student provided an incorrect answer to more than four times as many items as he or she answered correctly. For instance, if a student got six items correct, but answered the other 18 items incorrectly, then his or her adjusted number correct score would be zero ($6 - 18/3 = 0$). Adjusted number correct scores of zero or less were excluded because there is no scale score corresponding to zero correct; using the lowest score would artificially boost performance of floor effects. Over half of the cases were excluded – 6 from grade 5 and 12 from grade 6.

Table 2. Mean Scale Score by Level of Test and Grade

Grade	N	Mean Scale Score: In-Level Test	Mean Scale Score: Out-of-Level Test	t	p
5th grade	15	555	536		
6th grade	18	558	544		
Overall	**33**	**557**	**541**	**3.3**	**.002**

Table 3. Number of In-Level Scale Scores Falling Outside the 95% Confidence Band Around the Out-of-Level Scale Score

Grade	Mean Scale Scores Falling Outside Confidence Band: Above Band	Mean Scale Scores Falling Outside Confidence Band: Below Band
5th grade	4	0
6th grade	5	0
Overall	**9**	**0**

Table 4 displays the mean adjusted scale score by grade and by test level. Note that only 15 cases had adjusted number-correct scores greater than zero. Among the 5th graders, the in-level and out-of-level scale scores differed by only one point. Among 6th graders, the in-level mean scale score was 38 points *less* than the out-of-level mean. Overall, the mean adjusted scale score for the in-level test was 15 points *lower* than the mean adjusted scale score on the out-of-level test. This result is the opposite of the result shown without the correction. It is important to note that the unadjusted scale scores for these 15 cases were similar across levels (in-level = 576; out-of-level = 568).

The number of adjusted in-level scale scores that fell beyond the 95% of the adjusted out-of-level scale scores was also determined. Overall, five of the adjusted scores on the in-level test fell below the lower bound of the adjusted out-of-level score, whereas only one score fell above

Table 4. Mean of the Adjusted Scale Score by Grade and by Level

Grade	N	Mean Scale Score In-Level Test	Mean Scale Score Out-of-Level Test	t	p
5th grade	9	542	541		
6th grade	6	524	562		
Overall	**15**	**535**	**550**	**-1.6**	**.14**

the upper bound. It is unlikely that many scores would fall below the lower bound by chance; therefore, it would appear that after adjusting for random guessing one could expect the out-of-level score to result in a estimation of performance that is substantially higher than that reflected the in-level score.

Follow-up Questions

Following the completion of each test, students were asked to complete a five-item survey (see Appendix A). The proctor read each item and response option to the participants. Table 5 shows the distribution of responses. When students were asked to rate the difficulty of the test, 61% indicated that the test was really easy or kind of easy for both of the tests. When students were asked to indicate how many items made them feel frustrated, 70% indicated that none or just a few of the items on the in-level test made them frustrated compared to 85% indicating this on the out-of-level test. When students were asked to indicate how many items they did not know how to do, for the in-level test, 76% indicated that they did know how to do just a few of the items, compared to 82% indicating this on the out-of-level test. None of these differences was statistically significant.

There was some concern that students would find the word problems more difficult. Even though criteria for eligibility required that the student could read at least at a basic level, there was some sentiment that many students would struggle with reading. When asked whether they found it hard to read the word problems, 76% of the students indicated that the word problems were not hard to read for either test. When students were asked whether it was hard to understand what the word problems were asking them to do, 48% indicated that the word problems on the in-level test were not hard to understand compared to 45% on the out-of-level

Table 5. Percent of Participants Choosing Each Category

	Percent Giving Response	
Question	**In-Level Test**	**Out-of-Level Test**
How hard was the test?		
Really easy – kind of easy	61	61
How many items made you frustrated?		
None – a few of them	70	85
How many items asked you to do something you NOT know how to do?		
None – a few of them	76	82
Did you find it hard to read the word problems?		
No	76	76
Did you find it hard to understand what the word problems were asking?		
No	48	45

test. Further analysis of the test data also indicated that students did not seem to have more difficulty with the word problems than with the other problems. For those students with low scores on the out-of-level test (less than 40% correct), about 25% correct was obtained for both the word problems and the non-word problems. Reading difficulties did not appear to influence the results of this study.

Testing Time

Another factor that could potentially influence the scale score comparison was the degree to which students tried their best on both test. We could not measure students' effort directly, but we could infer lack of effort for students who spent very little time taking the test. In this study, students were provided with as much time as they needed to complete the test. The average test-taking time was 19.3 minutes on the first test and 15.8 minutes on the second test. The test publisher recommends allowing 30 minutes to complete the 24-item Math Procedures section. We suspected that test taking time might have been shorter for the participants in our study because they were instructed to skip the items that they did not know how to do. On average, the participants responded to 22 items on the first test and 21 items on the second test. Students spent an average of 54 seconds per item on the first test, counting only those items for which they provided a response, and 46 seconds per item on the second test.

It seemed reasonable to expect students to spend at least 30 seconds per item on these tests, especially considering that the in-level test was difficult for this group. Furthermore, it seems highly unlikely that a student getting most of the items wrong, and spending less than 30 seconds per item was giving much effort. Four students spent less than 30 seconds per item while also getting fewer than 25% of the items that they responded to correct.

We reanalyzed the data for the scale score comparison after removing these four cases. Overall, the mean scale score on the in-level test for these 29 participants was 547 and the mean score on the in-level test was 557. The measurement error band around the out-of-level score ranges from 533 to 561. The mean scale score on the in-level test falls within this range. After making an adjustment for random guessing the mean scale score was 537 on the out-of-level test and 543 on the in-level test.

Discussion

The primary purpose of this study was to evaluate scale score comparability across two levels of a math computation test administered to students with learning disabilities whose instruction was about two grade levels below the grade in which they were enrolled. It was not designed to address either the concern about whether out-of-level testing lowers expectations, nor whether out-of-level testing represents a sound measure of performance against standards. These are important concerns that must be addressed as standards-based reforms continue to be implemented. Concerns about whether students are having exposure to grade-level content must be examined. Remedial work cannot sacrifice continued exposure to grade-level content.

This study was an attempt to extend the results of prior comparability studies by imposing stricter criteria for eligibility, and by making the comparison both with and without a correction for random guessing. The results demonstrated that the average scale score on the in-level test was significantly higher than the average score on the out-of-level test when there was no adjustment made for guessing. In contrast, the out-of-level score was higher than the in-level scale score when adjustments for guessing were made on both tests. The difference in results occurred because the average number of incorrect responses (excluding omitted responses) was greater on the in-level test (Mean =14) than on the out-of-level test (Mean=12). Because guessing represents systematic error, it has the effect of biasing performance estimates upward; therefore, the performance estimate on the out-of-level test generally represented a more accurate estimate of "true" performance. This conclusion is still premiminary, however, because of small numbers of students and the exclusion of over half of them in our adjustment for guessing. It is unlikely that test publishers eliminate scores in the same way that we did here.

Even though the out-of-level scores may have been less contaminated by guessing, it does not necessarily follow that an out-of-level score is more valid. Validity depends on the purpose of the test and the inferences one wishes to draw from the scores. The decision to use out-of-level testing should be guided by the purpose of the test. Most achievement tests are designed such that the items are representative of a particular domain. Under certain conditions, namely overlap of content and skills across levels, adequate vertical scaling, and a sound mechanism for assigning students to test levels, the out-of-level test score will generally result in a more precise performance estimate and more accurate inferences for students for whom the in-level test is too hard.

Better precision (i.e., more reliable measurement) is almost guaranteed when students are appropriately assigned to test levels. On most achievement tests, measurement precision is greatest for scores that fall near the mean of the number correct distribution, and decreases exponentially in the tails. This fact was one of the driving forces behind out-of-level testing. We found that more than twice as many participants scored in the reliable range on the out-of-level test than on the in-level test; therefore, overall group performance was more reliably estimated on the out-of-level test. Still, a number of students (n = 7) did perform within the reliable range on the in-level test, suggesting that teachers' perceptions about their students' levels of performance might be inaccurate.

It is sometimes argued that out-of-level testing is not appropriate for testing situations in which criterion-referenced inferences are drawn from the scores (Arter, 1982). A common example of a criterion-referenced inference is the determination of whether a student is proficient on some pre-defined content standards. Most state testing systems are designed for this purpose (Olson, Bond, & Andrews, 2000). If these state tests were actually developed in the same way as norm-referenced tests, with vertically linked levels aligned to the same standards, it is possible that inferences from out-of-level test scores would still be valid. However, it is rare even in states that allow out-of-level testing on their criterion-referenced tests to have out-of-level tests that were designed to meet those conditions – these states often use the test intended to measure standards in lower grades as their out-of-level test (Minnema et al., 2001). Because most states do not test in every grade, this usually means that a test designed for students at least two grades lower is used. It is unlikely that a statistical or content link has been established in those situations. Thus, the findings of our study on score comparability do not apply to the standards-based criterion-referenced tests in most states.

Increasing the reliability of measurement for students with disabilities is a growing concern in statewide standards-based testing programs. Concern that the tests are not sensitive to improvements among the students falling in the lowest proficiency levels is growing. Students with disabilities score below the proficient level on state tests at a much higher rate than do students without disabilities (Bielinski, Thurlow, Callender, & Bolt, 2001). While some states have gone to out-of-level testing, others have further divided their lowest proficiency levels in the hope that this will refine measurement of student performance at the lowest levels. Unfortunately, this latter approach will not improve the sensitivity of the test for detecting real growth among the low performing students. Measurement of performance in the lowest proficiency level tends to be unreliable. Movement between "sublevels" within the lowest proficiency level will be heavily influenced by random error, rather than real growth. As such, one can expect large fluctuations (up and down) from year to year in the percent of the students within each sublevel. If states are serious about improving measurement for these students, they should consider adding more easy items. Among the ways that this might be done are (1) making the tests longer, (2) dividing the tests into levels that differ in terms of difficulty, but that overlap sufficiently in term of item content and skill, and (3) redistributing the difficulty so that there are more of the easy items and less of the moderate and difficult items.

Our results suggest that the vertical linking studies conducted by the test publisher of the norm-referenced test we used (MAT7) were sufficiently robust to allow for testing students with disabilities on math computation two grades below grade level under the caveats of our study, so long as there is an adjustment made for random guessing. This result is important, because students with disabilities for whom an out-of-level test two levels below grade level is warranted, are probably underrepresented in the linking studies conducted by test publishers (Psychological Corporation, 1993). This finding should *not* be generalized to testing systems in which adequate vertical scaling procedures have not been used, such as is the case for most statewide standards-based testing systems.

The criteria for participation in this study were probably more conservative and thorough than what is used in practice to assign students to an out-of-level test. We presented our criteria to and had discussions with the special education teachers in order to ensure that the students they nominated met the eligibility criteria. Despite our effort to ensure that out-of-level testing was warranted for the students, there was still a handful who obtained a score within the reliable range (i.e., more than 40% correct) on the *in-level* test. These students represent the false positives; that is, students for whom out-of-level testing seemed to be warranted, but who performed well enough on the in-level test that out-of-level testing might not have been most appropriate. After the adjustment for guessing, the scale score on the in-level test fell within the 95% confidence range of the scores on the out-of-level tests, indicating that either score was fairly accurate, as long as the test was like that used in our study – a test with vertically equated levels. Still, the fact that students could be possibly inappropriately identified as candidates for out-of-level testing even with the strict eligibility criteria used in this study suggests that districts and states that allow out-of-level testing should include multiple safeguards to ensure access to the highest level of the test appropriate.

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