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Extended Time as an Accommodation on a Standardized Mathematics Test: An Investigation of its Effects on Scores and Perceived Consequences for Students with Varying Mathematical Skills[1]

Stephen N. Elliott and Ann M. Marquart

A primary strategy for including many students with disabilities in statewide accountability systems is to provide them with accommodations on large-scale, standardized tests. Typically, teachers provide students with multiple accommodations as needed; one of the most frequently used accommodations is extended time. Extended or extra time is often needed when assistance is given to students, and it is frequently used as part of a package of accommodations teachers provide to students with disabilities (Schulte, Elliott, & Kratochwill, 2000). It has been observed that time and speed of response are constructs that rarely, if ever, appear in the state or district content standards that large-scale assessments are designed to measure. Time is actually more of a test management issue than a construct to be measured in learners (Elliott, Braden, & White, 2001). Nevertheless, the amount of time allowed to respond to questions on a test is highly important to most test takers. Thus, the goal of this study was to conduct an experimental analysis of the effects of an extended or extra time accommodation on the test performance of students with varying skill levels in mathematics. We considered the effects and consequences of this accommodation from both validity and students' psychological perspectives.

Accommodations and Test Score Validity

Accommodations are "changes in standardized assessment conditions introduced to 'level the playing field' for students by removing the construct-irrelevant variance created by their disabilities" (Tindel & Fuchs, 1999, p. 9). In less technical terms, "the purpose of an assessment accommodation is to allow students with disabilities to show what they know without the impediment of the disability" (Elliott, Ysseldyke, Thurlow, & Erickson, 1998, p. 22). For the students with disabilities who participate in assessments with accommodations, information is needed regarding which accommodations are valid—that is, which accommodations maintain the integrity of students' test results so that meaningful comparisons can be made between their scores and (a) scores of students without disabilities (for norm-referenced testing) or (b) academic standards (for criterion-referenced testing).

Many would argue that the use of testing accommodations (e.g., extended time) directly contradicts the nature of norm-referenced standardized testing. When test results are not obtained under nearly uniform conditions, error is introduced into individuals' scores, thereby reducing the validity of resulting scores (i.e., the degree to which tests are thought to measure a particular construct equally across individuals). Geisinger (1994) pointed out that the extent to which accommodations (i.e., nonstandardized testing procedures) are used to elicit students' true performance on a test correlates with the amount of error that may be introduced into the testing

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process. Furthermore, as McDonnell, McLaughlin, and Morison (1997) noted, there are significant consequences of not knowing the degree and nature of the impact accommodations may have on students' test scores.

Many educators and researchers subscribe to the accommodation-disability interaction paradigm articulated by Phillips (1994). Under this paradigm, a valid accommodation is a tactic that removes barriers due to particular disabilities (or, more specifically, due to deficits in the specific access skills that enable students to perform to their potential on a test), thereby improving students' performance and allowing their true skills to be shown. The assumption of this paradigm is that because students without disabilities do not apparently have barriers to be overcome, the use of accommodations with these students should not significantly improve their scores.

At this point, educators are often unable to make evidence-based decisions about which accommodations to endorse because relatively little experimental research has examined the effects of accommodations on students' test scores. Thus, without the guide of empirically supported accommodations, states vary in the accommodations they advocate, with the result that accommodations permitted in one state may be prohibited in another (Elliott, Thurlow, & Ysseldyke, 1996; Siskund, 1993).

Some of the differences in states' accommodations guidelines are legitimate due to different types of tests (i.e., norm-referenced vs. criterion-referenced). However, some of the differences are also due to the lack of strong experimental evidence about the effects of accommodations. For example, 39 states report allowing extended time as a permissible scheduling accommodation, whereas 2 states prohibit this accommodation (Thurlow, Seyfarth, Scott, & Ysseldyke, 1997). States also differ in their definitions of extended time, variously defining the accommodation to mean (a) the provision of additional time to allow breaks after certain blocks of time, (b) the provision of additional time in an amount to be determined by what is beneficial for a particular student, and (c) testing over multiple sessions (Thurlow et al., 1997).

The question of whether to provide accommodations to students without disabilities can be controversial. Many students who are at risk academically but lack special education labels receive instructional accommodations from teachers in the classroom and might also benefit from accommodations on large-scale tests (Koretz, 1997). In fact, five states have established guidelines for providing accommodations to students based on their educational needs rather than whether they have an individualized education program (IEP) (Elliott, Thurlow, & Ysseldyke, 1996).

The Effects of Extended Time for Students With and Without Disabilities

To date, most published research on extended time testing accommodations has involved college students taking high-stakes entrance exams, such as the Scholastic Aptitude Test (SAT) or Graduate Record Examination (GRE) (Centra, 1986; Runyan, 1991). Tindal and Fuchs (1999) reviewed studies that have examined the impact of extended time on college students' test performance, and we briefly review many of these studies here. However, we omit from our

review studies conducted earlier than the 1980s and unpublished manuscripts or dissertations (for which no abstracts were available).

Several studies have obtained a similar pattern of results in investigating the effects of extended time on college students' performance on various types of academic tests (Alster, 1997; Centra, 1986; Hill, 1984; Runyan, 1991). Generally, researchers have found that extended time has a differential effect for students with and without disabilities. Students who do not have identified disabilities tend to exhibit similar levels of performance under timed and untimed testing conditions, whereas students with disabilities significantly improve their scores when extended time is provided. In a study conducted by Hill (1984), students with disabilities scored significantly lower on the American College Test (ACT) than students without disabilities in the timed condition; however, the scores of the two groups of students did not differ significantly in the untimed condition. Similarly, Centra (1986) found that students with disabilities significantly improved their SAT scores when given extra time, and this dramatic change in performance did not occur for students without disabilities. Consistent results were also obtained by Alster (1997), who found that college students with learning disabilities scored significantly lower than students without learning disabilities on timed algebra tests, but their performance on untimed tests was comparable to that of nondisabled students on both the timed and the untimed tests.

The results of studies investigating the effects of extended time on the performance of students with and without disabilities at the elementary and middle school levels have been more mixed than those obtained in studies with college students. Perlman, Borger, Collins, Elenbogen, and Wood (1996) tested the effect of extra time on the performance of fourth- and eighth-grade students with learning disabilities on a standardized reading test (the reading comprehension subtest of the Iowa Test of Basic Skills [ITBS]). They found that students with learning disabilities in both grades significantly improved their scores on the standardized reading test when extra time was provided. Unfortunately, these researchers did not include students without disabilities in the study, so comparisons of the effects of extra time on students with and without disabilities could not be made.

Huesman and Frisbie (2000) examined the effect of extended time on the ITBS reading comprehension scores of disabled and nondisabled sixth-grade students. These researchers hypothesized that the use of extended time would reduce the variance associated with disabled students' slower rate of processing information, by giving these students enough time to adequately show what they knew. A portion of the sample took the test only under the extended time condition, whereas most of the sample took the test under two different conditions: (a) a standard time condition (20 minutes) and (b) an extended time condition (additional blocks of 20 minutes until they completed the test). Huesman and Frisbie found that students with disabilities made significantly larger test score gains than students without disabilities in the extended time condition as compared with the standard time condition. Students with disabilities used an average of 16 additional minutes to complete the test in the extended time condition, whereas students without disabilities used an average of 7 additional minutes. Therefore, most students, with or without disabilities, finished the test within the first 20-minute block of extended time.

In contrast, however, researchers in two other studies found that extended time did not necessarily benefit students with disabilities more than students without disabilities. For

example, Munger and Lloyd (1991) administered alternate forms of math and language ITBS tests to fifth graders under timed and untimed conditions and found that (a) the two groups of students completed the tests in similar amounts of time and (b) the performance of the groups was not differentially affected when extended time was provided. Similarly, Fuchs, Fuchs, Eaton, Hamlett, and Karns (2000) found no significant gains in performance by students with disabilities on an untimed standardized math test as compared with the performance of students without disabilities. However, extended time was one of four accommodations that significantly improved the performance of students with disabilities on a more innovative, problem-solving, curriculum-based measurement.

Academic Skills and the Effectiveness of Extended Time

The studies discussed thus far looked only at the effectiveness of accommodations for students with and without disabilities. Other studies have considered the role that academic skills might play in the degree to which accommodations influence students' test performance. Researchers have theorized that a student's level of academic skills—and not necessarily the presence of a disability—may interact with the effectiveness of accommodations. Several teams of researchers have hypothesized that accommodations may significantly improve the performance of students with lower academic skills but not the performance of students with average or higher academic skills (Koretz, 1997; Phillips, 1994; Tindal & Fuchs, 1999).

Only a few researchers, however, have examined the role academic skills might play when students are provided the accommodation of extra time. Most findings from these studies support the predicted impact of academic skills on the effectiveness of accommodations, although some contradictory results have also been found. Halla (1988) looked at the influence of extended time on students' GRE scores. In this study, students completed the GRE under timed and untimed testing conditions. Using IQ score as a measure of academic ability, Halla conducted a mean split to control for IQ and examined the performance of students whose IQs fell above and below 117. He found that extra time significantly benefited all students, but that the students with learning disabilities whose IQs were below 117 scored significantly lower on the timed test than students without disabilities.

In a study by Harker and Feldt (1993), high school students were placed into low, middle, and high reading groups based on their skill level (as determined by their percentile rank on the ITBS). The students completed four different reading subtests under two testing conditions: (a) a standardized administration with time limits and (b) an audiotape administration with no time limits. Two major findings from this research are important to note: First, differential effects were obtained as a function of students' reading level, meaning that poor readers benefited more from the audiotapes than good readers. Second, extended time was a secondary accommodation attributable to the time needed to administer the audiotapes. Extended time thus improved students' performance indirectly via the primary accommodation of audiotape administration.

The results of a study conducted by Montani (1995) showed a significant interaction between students' specific disabilities and testing condition. Children identified as having low math skills performed significantly worse on a math test than students with no academic difficulties in a timed condition but not in an untimed condition. However, the scores of children identified as having both low reading and low math skills did not significantly improve in the

untimed condition. The researchers found that the students with a specific math disability were able to use additional strategies (e.g., counting on their fingers) in determining their answers in the untimed condition, thereby enabling them to perform similarly to students without academic difficulties.

Individuals' Reactions to the Use of Testing Accommodations

Another aspect of the effects of testing accommodations that was explored in this study was individuals' reactions to their use. Few published studies have examined students', teachers', and/or parents' attitudes toward the use of accommodations with students with disabilities on statewide, standardized tests. A study by Perlman et al. (1996), described earlier, obtained some interesting results regarding the impact of extra time on students' performance. The researchers found that when students with disabilities were given extra time to work on a test, they did not actually use it! Remarkably, all of the students except one completed their tests within the standard time limits. In addition, all of their scores were significantly higher in the extra time testing condition. These findings indicate that the provision of extra time may serve to reduce students' anxiety about completing the test quickly, thereby raising students' performance.

Social learning theory provides a theoretical context for exploring students' attitudes toward and perceptions of accommodations. Bandura (1997) hypothesized that cognitive processes influence how information gleaned from observations is perceived, interpreted, and ultimately used to produce behaviors. He argued that a sense of self-efficacy—that is, competence in dealing with the environment—is a very important psychological variable that can influence overall functioning. For example, individuals' level of self-efficacy influences the degree to which they attribute academic successes to their own skills and effort rather than to some other uncontrollable factor, such as luck. Therefore, it is critical to understand the way students perceive the use of accommodations in order to gauge the impact accommodations have on students' self-efficacy beliefs. On the one hand, they may view accommodations as strategies that enable them to demonstrate their best work and that they may eventually learn to use independently. On the other hand, they may see accommodations as indicative of the skills they lack to complete tests successfully on their own. Evidence supporting both of these types of reactions to the use of accommodations has been reported when high school students with disabilities have been shown the accommodations listed on their IEPs (Elliott et al., 1998). Although some students were surprised or relieved to find out that they were allowed to have certain accommodations, others reacted more negatively, stating that they would not want to take the test with help or in a different room than the rest of the class.

Summary

Although it appears that extended time generally "levels the playing field" for college students with disabilities, findings from a few studies on elementary and middle school students have been less clear-cut. Thus, in the current investigation we chose as participants middle school students with and without disabilities and used an experimental research design to investigate (a) the effects of extended time on students' performance on achievement tests, (b)

the effects of academic skills on the effectiveness of extended time, and (c) students' reactions to the use of extended time.

Method

Participants

Students. The primary participants were 69 eighth-grade students recruited from four middle schools in four Iowa school districts. Parental consent was required for students' participation. The sample consisted of a nearly equal number of males and females, divided into three groups.

The first group consisted of students with identified disabilities (n = 23) receiving special education services. Although Iowa does not use labels to classify students by the specific types of special education services they receive, our participating students with disabilities were a heterogeneous group, including students with mild learning disabilities, emotional disabilities, behavioral disabilities, mild physical disabilities, speech and language disabilities, and mild cognitive disabilities. All students with disabilities who participated in this study were receiving special education services specifically in the area of math and had at least one IEP goal in this area. We included students with disabilities in the study *only* if extra time was listed on their IEPs as an appropriate testing accommodation.

The second and third groups in the study consisted of students without identified disabilities. Half of these students (n = 23) were rated as *educationally at risk in the area of mathematics* by their teachers, and the remaining half (n = 23) were performing at or above grade level in math. Each of these two groups (students without disabilities and students educationally at risk in math) was identified via teacher ratings of students' mathematical skills using the Academic Competence Evaluation Scale (ACES). We included these two groups in the study so that we could compare the effects of testing accommodations on students of varied academic skill levels.

Teachers. We recruited 8 teachers to assist in obtaining students for the study and to complete a portion of the ACES. This sample included 4 special education teachers, 3 general education math teachers, and 1 teacher in an "at-risk" program. Teachers were paid a stipend of $25 for their involvement in the study.

Materials

Standardized math tests. Students completed alternate short forms of standardized mathematics tests developed from the TerraNova Level 18 mathematics test (CTB/McGraw-Hill, 1998). Two equivalent forms of the mathematics test at the eighth-grade level were developed by research staff at CTB/McGraw-Hill (Forms A and B). The test development process involved three steps: (a) identifying the test objectives; (b) matching individual test items to those objectives; and (c) selecting items for each short version of the test that covered the same test objectives, were at approximately the same level of difficulty, were worth the same number of points, and fit the standard error curve. After selecting items for the alternate tests, the CTB staff

double-checked the match of the short forms to the original long forms by plotting the test characteristics and standard error curves of each short test to its corresponding long form. They used the same process to determine the match across Forms A and B. The results of these procedures indicated that all tests were measuring the same constructs and had the same levels of difficulty and the same floors and ceilings (D. Lewis, personal communication, July 9, 2000). Each form of the math test consisted of 15 multiple-choice items, and the testing guidelines provided by the research team indicated that the standard administration time was 20 minutes. Students' test booklets were hand-scored, and raw scores represented the number of items students answered correctly out of the total of 15.

Accommodations survey. We asked students to complete an accommodations survey immediately after finishing the math test so we could gather data about their reactions to working on the test under the accommodated and non-accommodated testing conditions. Specifically, we asked students about their perceptions of the usefulness of the accommodation (extra time), the difficulty of the test, and their motivation and interest in completing the test with and without the accommodation.

Academic Competence Evaluation Scale (ACES). The Academic Competence Evaluation Scale (DiPerna & Elliott, 2000) is a tool for teachers to assess students' overall academic competence via measures of students' study skills, academic skills, academic motivation, interpersonal skills, and academic self-concept. For the purposes of this study, we were specifically interested in assessing students' mathematics performance in the classroom; therefore, we used only the eight mathematics items from the ACES academic skills scale. We asked teachers to rate "the quality of student performance in various academic skills" by comparing students with "the grade-level expectations at their school" (2000, p. 5). Teachers rated students' academic skills on a scale from 1 to 5, with 1 indicating "far below" grade-level expectations, 3 indicating "adequate," and 5 indicating "far above" grade-level expectations. Students receiving a total score of 21 or less on the eight math items were determined to be educationally at risk in the area of math.

Assessment Accommodations Checklist (AAC). The Assessment Accommodations Checklist (Elliott, Kratochwill, & Schulte,1999) is a tool for educators to use in planning and documenting the accommodations used with students with disabilities. The checklist provides 67 accommodations (and spaces to add other accommodations) within each of eight domains: (a) assistance prior to administration of test; (b) motivation; (c) scheduling; (d) setting; (e) assessment directions; (f) assistance during assessment; (g) equipment or assistive technology; and (h) changes in test format. The general purpose of the AAC is to assist educators in planning the accommodations to be used when administering tests to students with disabilities. For purposes of this study, the AAC was completed by teachers to document the accommodations listed on students' IEPs and/or the reasonable testing accommodations teachers would recommend be used with the students. AACs were completed both for students with disabilities and for students identified as educationally at risk in math. Although this study focused on the specific accommodation of extra time, we used the AAC to document the package of accommodations listed on students' IEPs.

Procedure

Once we obtained consent for participation in the study from teachers and parents, we asked teachers to rate students on the eight mathematics items of the ACES academic skills subscale. If teachers' ratings totaled 21 or less, students were identified as having low skills in the area of math and were placed in the "educationally at risk in math" group for purposes of this study. We placed students with total ratings of 22 or more in the "students without disabilities" group. Either the teachers or the second author reviewed IEPs for the students with disabilities and documented the testing accommodations that would be appropriate or helpful for each student based on (a) the instructional accommodations the student had received in the classroom, (b) the accommodations that would help the student compensate for access skills he or she lacked, and (c) for each student with disabilities, the testing accommodations listed on the student's IEP. Students with disabilities were included in the study only if their teachers listed extra time as an appropriate testing accommodation on the students' IEPs.

We administered the tests in students' math classes or study halls during the school day. Given the small numbers of students completing the tests during any administration, both testing conditions were employed simultaneously (i.e., some students were tested under the standard time condition while some students were tested under the extended time condition). This procedure served to reduce students' awareness of the amount of time others were taking to complete the test, because the students knew that different testing conditions were being implemented at the same time. Most testing sessions included students from all three groups (i.e., students with disabilities, students educationally at risk in math, and students without disabilities). Testing sessions typically took 1 to 2 class periods, depending on the school's schedule and the amount of extra time used by the students. Both the test forms (A and B) and the order of testing conditions (standard time first or extended time first) were randomly assigned across individuals within the three student groups.

We gave students 20 minutes to work on the test in the standard time condition. The extended time condition was defined as the amount of time the student used to complete the test beyond the standard 20 minutes, up to a maximum of 40 minutes. Students working under the accommodated condition were told they could take up to twice the standard amount of time to put forth their best attempt at completing the test. When these students had finished working on the test, they were asked to write down the time they stopped working so that the total amount of time they actually used to work on the test could be determined.

Immediately after completing the second test, students were asked to fill out a survey about their reactions to the use of the extended time accommodation in the study and also the use of other accommodations in the classroom.

Research Design, Data Analysis, and Predictions

The independent variables in this study were student group (3 levels: students with disabilities, students educationally at risk in math, and students without disabilities) and testing accommodations condition (2 levels: extended time, standard time), and the dependent variable was students' scores on the two forms of the standardized mathematics test. As previously noted, students' raw scores were the number of items they answered correctly out of the total possible

items (15). The primary design of this study measured the effect of extended time on the test scores of three groups of students. Also, a between-*series*, alternating treatments design (i.e., non-accommodated, accommodated) was embedded in the group design to provide comparisons of individual students' performance. The order in which conditions were presented to the students was random; approximately half of the students in each student group began with the control or non-accommodated condition, and the remaining students began with the treatment or accommodated condition. Thus, this design allowed for both *intra*individual and *inter*group comparisons, such that the performance of both individual students and groups of students on the two math tests could be compared across the two conditions.

Multiple data analyses were used to summarize and interpret the results of the study. First, we conducted two different intergroup analyses to examine differences between the groups of students. A repeated measures multivariate analysis of variance (MANOVA) was used to compare the difference in performance of students with and without disabilities across the two testing conditions. For this analysis, we combined students educationally at risk in math with the students without disabilities so we would be able to examine student performance on the mathematics test by disability category. A second intergroup analysis was conducted, again using a repeated measures MANOVA, to determine the extent to which the extended time accommodation affected the performance of students with varying levels of mathematical skills (i.e., students with disabilities, students educationally at risk in math, and students without disabilities). For each analysis, we used G-Power (Faul & Erdfelder, 1992) to calculate the predicted power to detect differences between the test conditions. With 69 students in each analysis, power was calculated at .92 critical $F = 5.09$; lambda = 15.50; indicating adequate power to detect true differences between accommodation conditions. In addition to the MANOVAs, effect sizes were computed for each group of students (those with disabilities and those without) across the two (accommodated and non-accommodated) conditions (Elliott & Kratochwill, 1996). To determine the effect size, we subtracted the group's mean standard time score from the group's mean extended time score, divided by the standard deviation of the standard time scores for the students without disabilities. An effect size of at least one-half standard deviation was considered indicative of significant change in performance across conditions (Cohen, 1992; Thompson, 1999).

Prediction 1. We predicted that the scores of students with disabilities would be significantly higher in the accommodated condition than in the non-accommodated condition, whereas the accommodation of extra time would not have a significant effect on the performance of students without disabilities. Thus, we expected disability and accommodations conditions to interact. We considered a significant interaction between disability group and testing condition evidence of meaningful change in students' test scores.

Prediction 2. We predicted that students' level of math skills, as judged by their teachers, would interact with the effectiveness of the extended time accommodation, such that students with low math skills (i.e., students considered educationally at risk in math and students with disabilities) would perform significantly better when extra time was provided, whereas students with higher math skills (i.e., students performing at or above grade level) would perform similarly both when extra time was provided and when it was not. We tested this prediction by conducting a MANOVA so that we could compare, as we did with regard to Prediction 1, the amount of change in performance obtained by each student group. Thus, comparisons were made

between (a) students with disabilities and students without disabilities, (b) students without disabilities and students educationally at risk in math, and (c) students with disabilities and students educationally at risk in math. We considered a significant interaction between student group and testing accommodations condition evidence of meaningful change in students' test scores.

Prediction 3. We predicted that students with disabilities, students educationally at risk in math, and students without disabilities would perceive accommodation as helpful in (a) reducing their anxiety about their performance, (b) enabling them to better demonstrate what they knew, and (c) increasing their motivation to complete the tests. Therefore, we expected that on the accommodations survey we administered, all students in all three groups would endorse "extended time" more frequently than "standard time" or "the conditions were the same" on a variety of statements regarding their emotional reactions to and their perceptions and evaluations of their experiences taking the tests under the two time conditions (see Figure 4). To test this prediction, we compared the number of times the three groups endorsed the extended time condition to the number of times they endorsed a non-accommodated condition (both "standard time" and "the conditions were the same").

Results

The data used to measure students' performance on the math tests were the number of items they answered correctly on each form of the test. The means and standard deviations for scores obtained by each group of students are presented in Table1 and served as the basis for testing the major predictions. Specifically, Table 1 presents the average number of items answered correctly (out of the total of 15), the standard deviations, and the differences in scores obtained under the two testing conditions for students with disabilities and the total group of students without disabilities (the "students educationally at risk in math" and the "students without disabilities" groups combined). The scores achieved in the extended time condition were higher than the scores achieved in the standard time condition for both groups. The average score obtained by students with disabilities was at least 3.4 points lower than the average score obtained by students without disabilities in both testing conditions. However, the increase in scores obtained by the students with disabilities was slightly less than the increase obtained by the students without disabilities.

Prediction 1: Not Supported

To assess the prediction that extended time would significantly improve the tests scores of students with disabilities, a repeated measures MANOVA was conducted to compare differences in the scores obtained by students with and without disabilities under both the standard and extended time conditions. We found a significant main effect for Disability Status, - $F(1, 95) = 51.34$, $p < .0001$, but no statistically significant multivariate effects for either the Testing Condition main effect, $F(1, 95) = 3.11$, $p = .08$, or the Testing Condition × Disability Status interaction, $F(1, 95) = .007$, $p = .93$. These outcomes therefore do not support the prediction that the scores of students with disabilities would improve significantly more than those of the students without disabilities in the accommodated condition as compared with the non-accommodated condition.

We computed effect sizes for each group of students (those with disabilities and those without) across the two (accommodated and non-accommodated) conditions. The mean effect size for students with disabilities (n = 23) was .26, and the mean effect size for students without disabilities (n = 46) was .34. Therefore, it appears that both groups benefited slightly from the extended time accommodation but that the students with disabilities did not improve their scores more than the students without disabilities, as expected. The students at risk for math problems benefited the most from the extra time accommodation with a mean effect size of .48.

Prediction 2: Partially Supported

We conducted a second repeated measures MANOVA to test differences in performance between the students with disabilities, the students educationally at risk in math, and the students without disabilities across the two testing conditions. Similar to the outcomes for Prediction 1, differences ranged from 1.6 to 4.29 points between groups in each testing condition, but within each group, students obtained very similar scores in both the standard and extended time conditions. The statistical tests of these differences indicated that there was a statistically significant multivariate main effect for Testing Condition, $F(1, 94) = 4.90$, $p = .03$, but the multivariate effect for the Testing Condition × Student Group interaction was not significant, $F(2, 94) = .376$, $p = .69$. Therefore, the scores obtained in the extended time condition were not significantly greater for any of the three groups of students. However, referring back to the raw scores for each group, some differences appear to exist between the three groups in the amount that their scores improved in the extended time condition. The students without disabilities improved their scores by .43 points in the extended time condition; the students at risk in math, by 1.04 points; and the students with disabilities, by .57 points. Therefore, although we did not find a significant multivariate interaction effect, we did find some evidence based on differences in students' mean scores to support the hypothesis that students with low math skills (i.e., students educationally at risk in math and students with disabilities) would perform better when extra time was provided, whereas students without disabilities would perform similarly both when extra time was provided and when it was not.

Effect sizes were computed for each individual student and for each student group (i.e., students with disabilities, students at risk in math, and students without disabilities). Table 2 presents the total number and percentage of small, medium, and large positive and negative effect sizes obtained for students in each group. These results suggest that a rather high percentage of students within each group experienced negative effects. However, follow-up analyses revealed that the order in which students experienced the two testing conditions may have contributed to the negative effect size outcomes. The average number of minutes used by the three student groups in the extended time condition ranged from 10.70 to 13.19 minutes, far less than was given during the standard time condition (20 minutes). Students with disabilities used significantly less time in the extended time condition if they had already taken the first test in the standard time condition. When students with disabilities were assigned to the extended time condition first, they used an average of 14.5 minutes. However, when the extended time condition was second, they used an average of only 8.73 minutes. For the students in the other two groups, the order of the two testing conditions did not have as great an impact on the number of minutes used in the extended time condition. The students at risk in math used 14.2 minutes when the extended time condition was first and 12.3 minutes when it was second. The students

without disabilities used 11.2 minutes when the extended time condition was first and 10.2 minutes when it was second. Thus, all groups did use fewer minutes during the extended time condition if it was their second testing condition, but this difference was more dramatic for students with disabilities than for the two other student groups.

Prediction 3: Partially Supported

Once students finished the second test, they were asked to complete a survey about (a) the strategies they used when they were given extra time to complete one of the tests and (b) their reactions to completing the tests with and without extra time.

Strategies used during extended time condition. We showed students a list of 13 strategies and asked them to place a check mark next to each strategy they recalled using during the test. Table 3 portrays the percentage of students from each group that used each of the 13 strategies. The strategies most frequently used across all three student groups were "answered every question," "reviewed pictures and/or graphs," "felt more relaxed," "reread questions," and "reviewed difficult items." The strategy used least frequently by all three groups was "underlined/circled parts of questions." It appears from this data that the ratings of students with disabilities differed from those of the other two student groups on three items: "worked at a slower pace," "guessed at some items," and "felt more motivated." Whereas fewer students with disabilities than students in the other two groups indicated that they worked at a slower pace in the extended time condition, more students with disabilities than students in the other two groups indicated that they felt more motivated in the extended time condition.

Reactions to different testing conditions. Students were asked to identify their reactions to taking the test under the two testing conditions by indicating whether (a) an evaluative statement was true for them in the standard time condition, (b) the evaluative statement was true for them in the extended time condition, or (c) the two conditions were about the same for them with regard to the evaluative statement. Table 4 presents the percentage of responses of the students with disabilities, students at risk in math, and students without disabilities that fell into the three response categories. Visual inspection of this table reveals that a large proportion of responses across all three groups endorsed the extended time condition. Specifically, students generally indicated that they felt more comfortable, felt more interested, felt more motivated, felt less frustrated, thought they performed better, thought the test seemed easier, and preferred taking the test under the extended time condition. It also appears that the students at risk in math provided the strongest endorsement of the extended time condition over the other two response choices, as this group had the lowest percentage of students choosing the standard time condition as their preference for each item except "felt less frustrated." In addition, with the exception of that same item, they had the highest percentage of students selecting the extended time condition, even over the students with disabilities.

We compared the proportion of students within each group that chose the accommodated, or extended, time condition over the other two choices to explore differences in students' preferred testing conditions. In other words, we combined the "standard time" and "conditions were the same" responses to form one category representing a non-accommodated testing condition. Confidence intervals were created around the observed proportions of students in each group that preferred the extended time condition. All confidence intervals obtained by each

group of students overlapped, indicating that there were no significant differences in the proportions of students within each group that endorsed the extended time condition over a non-accommodated test condition.

Discussion

The purpose of this study was to examine the differential effect of one accommodation, extended time, on the performance of students with and without disabilities on equivalent forms of a standardized math test. Comparisons were made between student groups based on disability status across the standard and extended time conditions. Overall, we obtained little evidence to support the prediction that the accommodation of extended time would interact with disability. Both students with and students without disabilities achieved highly similar levels of performance under standard time and extended time testing conditions. Comparisons of the degree to which raw scores and effect sizes obtained by students with and without disabilities changed between the standard and extended time conditions all showed that the provision of the accommodation—extended time—did not significantly improve scores of students with disabilities on a math test. Previous research with college students showed that students with disabilities performed significantly better than nondisabled students with extended time. The current finding is similar to outcomes obtained by two previous studies focusing on fifth and sixth graders, in which students with disabilities did not benefit more than students without disabilities when extended time was provided to complete a standardized test (Fuchs et al., 2000; Munger & Lloyd, 1991).

We obtained mixed results regarding the effect of students' math skills on the effectiveness of the extended time accommodation. Repeated measures multivariate analyses used to test the differences between students' scores in the standard and extended time conditions showed that no group benefited significantly more from the accommodation than the others. However, an inspection of the average number of items answered correctly by each group in each time condition showed that (a) all groups increased their number of correct answers in the extended time condition and (b) students with disabilities and students at risk in math showed higher gains than students without disabilities. Therefore, these scores provide some evidence to uphold the predicted interaction between academic skill level in math and the effect of the accommodation. This finding is consistent with studies conducted by Halla (1988) and Montani (1995), who found that students with low academic skills performed similarly to students with no academic difficulties when they were tested in an untimed (i.e., extra time) condition. However, previous research has also shown that academic skill level does not necessarily interact with the effectiveness of accommodations, as reported by Montani (1995) for students who had low academic skills in both reading and math. Given that academic skills and competence are measured in different ways by different studies, it is difficult to draw substantial conclusions about what role skill level actually plays in the impact of accommodations.

The calculation of effect sizes for individual students within each student group showed that the largest proportion of students across groups obtained either large negative or large positive effect sizes. Over 21% of the sample obtained large negative effect sizes, and about 40% obtained large positive effect sizes, whereas the remaining 39% fell into the "small positive," "small negative," or "no effect" categories. Within the groups, most of the students with disabilities fell into the "large negative," "no effect," or "large positive" categories, whereas

nearly half of the students educationally at risk in math obtained a "large positive" effect size. This finding is noteworthy because it shows that students at risk in math, who typically do not receive any testing accommodations, showed the greatest benefit in their scores as a result of the extended time accommodation.

We conducted a follow-up analysis to examine whether the order in which the testing conditions were presented affected students' performance. This analysis showed that the number of minutes used by students with disabilities during the extended time condition depended on whether that condition came first or second. When students with disabilities were given the extended time condition first, they used almost 6 more minutes to work on their tests than when the extended time condition was given to them second. We found similar but less dramatic differences in the amount of time used in the two testing conditions by the students at risk in math and the students without disabilities. It appears, therefore, that extra time as a single accommodation may not provide much benefit to students with disabilities on multiple tests or in multiple testing sessions. It may be that the degree to which students with disabilities can maintain an effective level of attention, effort, or motivation plays a larger role in determining their achievement on math tests than the factors educators hypothesize to be addressed by providing the accommodation of extra time, such as reducing students' level of anxiety, allowing time for processing, or providing more time for poor or slow readers. In other words, without explicitly teaching the students strategies for checking over their work or providing them with other accommodations that address their specific attention, motivational, or academic difficulties, the provision of extra time alone may have little positive impact on students' scores.

Strategies Used During Extended Time Condition

An exploratory component to this study examined what types of strategies, if any, students used when they completed the test under the extended time condition. The majority of all students in the study reported using most of the strategies, as 9 of 13 strategies listed were checked by over half of the sample. The top three strategies used by all students were answering every question, reviewing pictures and/or graphs, and feeling more relaxed when they had extra time to work. Examining the frequency of strategies endorsed by the three different student groups, we found a few differences in the numbers of students at risk in math identifying the use of certain strategies over others. The strategies that the students at risk in math reported using more than the students without disabilities were reviewing difficult items, double-checking answers, working at a slower pace, and feeling more relaxed in the extended time condition. The remaining strategies were used by these two groups to a similar degree. Likewise, a comparison of the strategies used by the students with disabilities and those used by the other two student groups showed that the students with disabilities differed on only a few items. The strategies that students with disabilities reported using more than the other student groups were guessing, reviewing pictures, working on skipped items, and feeling more motivated in the extended time condition. Fewer students with disabilities reported working at a slower pace or feeling more relaxed during the extended time condition than did the other student groups. This result appears consistent with the finding that students with disabilities used, on average, only about 12 minutes during the extended time condition, and only 8 minutes when it was their second testing condition. This finding is also similar to results obtained by Perlman et al. (1996), who found that students with disabilities did not utilize extra time when it was given to them. In that study,

however, students with disabilities did significantly improve their scores in the extended time condition, whereas that was not the case in the present study. Although the provision of extra time may serve to reduce students' anxiety about completing the test quickly, it is not always the case that students will consequently improve their performance.

Reactions to the Use of Accommodations

Even though the two testing conditions did not significantly change students' scores, the testing conditions did affect students' perceptions of the time factor, their emotional reactions to each testing condition, and their evaluation of their performance. Nearly all students responded more positively to the extended time condition than to the standard time condition, and as described above, the majority of students indicated that the extra time allowed them to use various strategies to check their work. Also, more students from each group endorsed the extended time condition rather than the response stating that the two testing conditions were about the same. When students' preferences for an accommodated versus a non-accommodated testing condition were compared, more students without disabilities than expected stated that they preferred to work on the test in the extended time condition and felt less frustrated working on the test in that testing condition. Students at risk in math also indicated that they thought they performed better, the test seemed easier, and they preferred to take the test with the accommodation of extra time. In contrast, the only statement for which the students with disabilities gave a high rating to the extended time condition was "I felt less frustrated working on the test." These outcomes are consistent with the theoretically based prediction that students' levels of self-efficacy will increase when an accommodation is provided because it helps students feel more capable of successfully completing the task at hand. However, the fact that students with disabilities did not endorse the accommodated condition more strongly than the other groups of students may suggest that students with disabilities require more than the single accommodation of extended time to bolster their levels of effort and/or their motivation to work on a test. Given that the students at risk in math showed the greatest gains in their test scores under the extended time condition, it is interesting to note that their endorsement of the extended time condition was also higher than that of the two other student groups for multiple items.

Limitations of the Study

Several factors regarding the implementation of this study limited the impact of the independent variable (i.e., testing condition) as well as the sensitivity of the primary dependent variable (i.e., students' test scores). One likely cause for the lack of differences across testing conditions is that there was a ceiling effect within both the standard and extended time conditions. That is, although test guidelines for the length of the standard testing condition were followed, students finished the tests in both the standard and extended time conditions with several minutes to spare. Of course, the time limits established by the test developers were intended to allow students sufficient time to read and respond to each item; the standard time condition was not intended to be a power test or a speed testing condition, simply a timed testing condition. Nevertheless, the fact that students had more than enough time in the standard time condition likely diminished the impact of the accommodation of extra time. When given twice as much time to work on the test, students neither took advantage of the extra time nor showed significant gains in their scores.

A second limitation is that the extended time accommodation provided in isolation is contrived and not realistic for most students, given that nearly all students with disabilities receive multiple accommodations on district and statewide tests. However, for the research purposes of this study, we evaluated this accommodation in isolation to ensure more experimental control over other potential influences on students' scores. Although the majority of students in the study reported using various test-taking strategies or feeling more relaxed when they took the tests in the extended time condition, none of the student groups showed significant gains with this accommodation. We conclude, therefore, that there must be other factors that improve students' test scores more significantly than additional time.

A final limitation of this study is its use of a group rather than a single-case design to examine the impact of extended time on students' test scores. The use of a group design was plausible for this study given that extended time is an accommodation provided to the majority of students with disabilities and that the intent of the study was examine the impact of extended time on the scores of students with various academic skill levels. However, the significant variability in the scores obtained by students in each group could not be investigated thoroughly via the group design. The computation of individual effect sizes provided some information regarding the impact of the extended time accommodation on the performance of individual students, but richer, contextual information about how the extra time influenced particular students is not available (e.g., observational data, behavior during testing condition, etc.). Fuchs et al. (2000) speak to the limitation of group designs in stating that "differential boost is not revealed with group analyses" and accommodations other than extra time "may speak to something essential to the underlying disability of some individuals, for whom individual differential boost may be evident" (p. 81).

Implications of Findings

One implication from this study is the suggestion that an accommodation such as extended time may affect students' psychological functioning more than their performance on standardized tests. If true, this would indicate that the use of extended time as a testing accommodation does not serve to invalidate or excessively inflate scores of students with disabilities but rather provides students with a more positive testing experience and facilitates improved performance by reducing test anxiety and emotional arousal and creating opportunities to utilize good test-taking strategies. The ratings provided by the students with disabilities in this study suggest that the accommodation of extended time may not have relaxed them as much as it did students in the two other groups, but it did lead them to feel more motivated to take the test.

Therefore, when teachers are deciding whether to provide extended time to students with disabilities, they need to begin by addressing questions of validity: What is the accommodation of extended time intended to do, and what outcomes will be used to monitor whether it has achieved the desired effect? By itself, extended time may not be a valid accommodation if it does not alleviate or eliminate the barrier to performance as expected. The function the extended time accommodation serves for one student may differ from the function it serves for another. If an accommodation such as extended time is provided to students without a clear purpose or expected impact on performance, the accommodation may actually have a negative effect on the student's test performance.

Validity concerns also call into question the utility and accuracy of the "interaction paradigm" that predicts a substantial improvement in scores of students with disabilities when an appropriate accommodation is provided. This paradigm is based on two primary assumptions: (a) that the accommodations being provided serve to remove the suppressing effects of the access skills students currently lack, and (b) that students' latent ability is greater than that suggested by the test scores they achieve without accommodation. However, by definition students with disabilities have significant difficulties performing the target skills being assessed, and despite the provision of an extended time accommodation, their test scores are likely to remain significantly lower than those of nondisabled peers. Therefore, it is difficult to determine what a lack of boost in scores on accommodated tests conveys about the effectiveness of the accommodation—specifically, did the accommodation provide access to the test so that the student's true low ability was assessed, or did the accommodation itself negatively affect the student's performance?

Researchers ironically need extra time to answer these questions because more research is needed. In the meantime, it seems reasonable, based on the data from this study, to allow extra time to students when their IEP members believe the accommodation will facilitate the students' meaningful engagement in a test that counts.

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Table 1

Mean Raw Scores and Standard Deviations Obtained by Students With Disabilities, Students at Risk in Math, and Students Without Disabilities in the Standard and Extended Time Conditions

Student group	Testing condition		
	Standard time mean (SD)	Extended time mean (SD)	Difference in scores
Students with disabilities (*n* = 23)	6.26 (2.28)	6.83 (2.41)	.57
Students at risk in math (*n* = 23)	7.83 (2.15)	8.87 (2.83)	1.04
Students without disabilities (*n* = 23)	10.55 (2.19)	10.98 (2.05)	.43
Students without disabilities + students at risk in math (*n* = 46)	9.70 (2.51)	10.32 (2.51)	.62

Table 2

Effect Sizes Obtained for Each Group of Students

Effect Size	Students with disabilities (*n* = 23)	Students at risk in math (*n* = 23)	Students without disabilities (*n* = 23)
Large (greater than .80)	9 (39.1%)	11 (47.8%)	8 (34.8%)
Medium (.50 – .80)	0 (0%)	0 (0%)	0 (0%)
Small (less than .50 but greater than .20)	2 (8.7%)	2 (8.7%)	4 (17.4%)
No effect (greater than -.20 but smaller than .20)	5 (21.7%)	2 (8.7%)	3 (13%)
Small negative (-.20 – -.50)	2 (8.7%)	3 (13.4%)	3 (13%)
Medium negative (-.50 – -.80)	0 (0%)	0 (0%)	0 (0%)
Large negative (greater than -.80)	5 (21.7%)	5 (21.7%)	5 (21.7%)
Average effect size for each group	.26	.48	.19

Table 3

Percentage of Students Who Used Strategies in Extended Time Condition

Strategy	Students with disabilities (*n* = 23)	Students at risk in math (*n* = 23)	Students without disabilities (*n* =23)	Percentage of total sample
When I was given extra time, I _____				
1. Answered every question	91%	87%	86%	88%
2. Reviewed difficult items	70%	74%	65%	70%
3. Reread questions	70%	74%	71%	72%
4. Double-checked my answers	65%	65%	41%	57%
5. Guessed at some answers	48%	35%	35%	39%
6. Eliminated possible answers	61%	57%	53%	57%
7. Reviewed pictures and/or graphs	83%	78%	78%	80%
8. Underlined/circled parts of questions	13%	9%	10%	11%
9. Looked for key words in questions and answer choices.	65%	65%	69%	66%
10. Worked on skipped items	22%	17%	22%	20%
11. Worked at a slower pace	43%	70%	61%	58%
12. Felt more relaxed	78%	87%	75%	80%
13. Felt more motivated	52%	35%	41%	43%

Table 4

Percentage of Students Who Preferred Different Testing Conditions

Statement	Standard time	Extended time	Conditions were about the same
1. I felt more comfortable taking the test.			
Students w/ disabilities	9%	52%	39%
Students at risk in math	4%	61%	39%
Students w/o disabilities	4%	63%	33%
2. I was more interested in the test.			
Students w/ disabilities	13%	48%	39%
Students at risk in math	4%	61%	35%
Students w/o disabilities	12%	49%	39%
3. I had more motivation to try my best on the test.			
Students w/ disabilities	26%	52%	22%
Students at risk in math	9%	65%	26%
Students w/o disabilities	12%	57%	31%

Table 4 (cont.)

Statement	Standard time	Extended time	Conditions were about the same
4. I felt less frustrated working on the test.			
Students w/ disabilities	13%	70%	17%
Students at risk in math	9%	61%	30%
Students w/o disabilities	0%	67%	33%
5. I think I performed better on the test.			
Students w/ disabilities	22%	65%	13%
Students at risk in math	4%	70%	26%
Students w/o disabilities	8%	59%	33%
6. The test seemed easier for me.			
Students w/ disabilities	13%	52%	35%
Students at risk in math	4%	78%	17%
Students w/o disabilities	8%	59%	33%
7. Overall, I preferred to work on the test in the _____.			
Students w/ disabilities	13%	61%	26%
Students at risk in math	4%	74%	22%
Students w/o disabilities	8%	71%	22%