The Effect of Extended Test Time for Students with Attention-Deficit Hyperactivity Disorder

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Abstract

The purpose of the present study was to investigate whether a specific testing accommodation (extended time) affects test scores for college students with and without ADHD. College students with ADHD (N=61) and without ADHD (N=68) took a math test, after having been told they had either standard time or extended time to complete the test. Results indicated that the testing condition (i.e., extended versus standard time) had no significant effect on test scores or on the amount of time students took to complete the test. However, students with ADHD, on average, took more time to complete the test, attained lower test scores, and had lower state self-esteem than students without ADHD.

Keywords: Attention-Deficit Hyperactivity Disorder, testing accommodations, extended time

Academic accommodations are intended to change some part of the testing environment to compensate for limitations imposed by an individual's documented disability (Elliot, McKevitt, & Kettler, 2002; Lee, Osborne, Hayes, & Simoes, 2008). According to the Americans with Disabilities Act (ADA), the accommodations allow the individual with physical or psychological conditions to demonstrate his or her ability and knowledge without the hindrance of the disability. However, there are conflicting opinions regarding testing accommodations for postsecondary students with disabilities. Researchers debate whether testing accommodations for students with disabilities can adequately compensate for the effect their disability has on their test scores. Additionally, researchers question what types of testing accommodations are appropriate for students with specific disabilities.

One specific disorder, Attention-Deficit/Hyperactivity Disorder (ADHD), represents one of the most frequent disabilities for which students request accommodations on the ACT and SAT (Moore, 2010). This lifelong neuropsychological disorder has a significant influence on individuals' ability to attend to and concentrate on tasks, including academic work. Individuals with ADHD often have deficits in the ability to plan, organize, and inhibit behavior (Barkley, 2008; Biederman et al., 2006). Further, individuals with ADHD are less able to redirect their attention back to a relevant task once their attention is diverted and are less able to sustain that attention (Barkley, 1999; Barkley, 2008; Biederman et al., 2006; Faraone, 2000). In postsecondary settings, testing accommodations address the academic problems of students with ADHD that are believed to be related to the disorder. These accommodations may include altering the test presentation, the response format, the time boundaries, or the test setting (Elliot, et al., 2002). Specific accommodations include, among others, extended time, testing in a distraction-free environment, and oral test presentation (Elliott et al., 2002; Elliott & Marquart, 2004).

However, it remains unclear whether these accommodations are effective and for whom. Extended time is one of the most frequently-accessed testing accommodations, yet a recent meta-analysis concluded

that extended time improves the performance of both students with and without learning disabilities and that students without disabilities outperformed students with disabilities even when extended time was provided (Gregg & Nelson, 2010). These authors found that many of the studies of the extended time testing accommodation used mixed-disability groups, making conclusions about the effectiveness of a given accommodation for a specific disability impossible. Although Gregg and Nelson (2010) were able to identify nine studies that fit their learning disability meta-analysis inclusion criteria, fewer studies comparing students with and without ADHD exist and more are needed (Pariseau, Fabiano, Massetti, Hart, & Pelham, 2010).

Not only does more research evaluating the effectiveness of specific test accommodations for specific disabilities need to be conducted, emotional and behavioral variables that affect test performance should also be examined. Lewandowski, Lovett, Codding and Gordon (2008) found that both students with and without ADHD perceive themselves to have academic and testing problems. Elliot and Marquart (2004) indicated that 8th grade students both with and without disabilities experienced more motivation, interest, and comfort in an extended time condition as compared to the standard time condition. Similarly, college students with ADHD indicated distaste for timed tests, citing negative psychological consequences of time pressure (Lee et al. 2008). These findings suggest that extended time may help students by reducing test anxiety (Lovett, 2011). Along similar lines, Inzlicht and Kang (2010) investigated how certain emotional factors may affect how individuals perform during testing. They explored affect and self-esteem and their relationship to self-control and thus performance during testing. Using the Positive Affect Negative Affect Schedule (PANAS) and the State Self-Esteem Scale (SSES) to measure affect and self-esteem, respectively, Inzlicht and Kang (2010) found that both were correlated with test performance when female college students completed a math test.

Despite the ubiquity of extended time as a testing accommodation, past research has left many questions about its effectiveness unanswered. For example, few studies with students with a single, shared disability have been conducted and investigators have often overlooked the emotional and psychological variables that may account for testing differences between groups, beyond that accounted for by the accommodation itself. The purpose of the present study was to investigate whether a specific testing accommodation (extended time) affects test scores for college students with and without a specific disability (ADHD). It was hypothesized that students with ADHD who were told they have the standard time to complete a test would have lower test scores than both students with ADHD who were told they have extended time and students without ADHD who completed the same test. However, it was also hypothesized that students with ADHD who were told they have extended time to complete a test would not have significantly different scores than those without this diagnosis who completed the same test.

Method

Participants

Participants were 129 college students, of whom 33% were male and 67% were female. The majority were Caucasian (85.27%), followed by African-American (5.43%), Biracial and Asian (both 2.33%), and Hispanic/Latino (1.55%); 3.12% were of other races. The average age of the participants was 21.64 (SD = 6.41), ranging from ages 18 to 61 years. The majority of the participants were not taking any medications (77.52%). Of those who were taking medication (22.49%), one was taking non-stimulant medication and the others were taking stimulant medication. Of the total sample, 14.73% indicated that they had a diagnosed Learning Disorder and 6.21% indicated that they had some other mental health diagnosis.

Of the participants, 61 identified as having an ADHD diagnosis and 68 participants did not. Participants with ADHD were recruited from the Students with Disabilities Services office. The groups with and without ADHD did not differ significantly by gender or race. Although age was correlated with time taken on the test ($r = .33$, $p < .0001$) and negatively correlated with test scores ($r = -.18$, $p < .05$), the groups did not significantly differ by age ($t\ (127) = -1.58$, $p > .05$). Further, although number of previous math courses taken did correlate with math test scores ($r = .21$, $p < .05$), the groups did not differ by number of math classes taken ($t\ (127) = -.47$, $p > .05$). Information regarding the level of previous math courses taken was not gathered, nor was any standardized measure of math ability; therefore it was not possible to compare the groups on these variables.

Participants who had ADHD were more likely than those who did not have the diagnosis to identify as being an upperclassman in college ($\chi 2\ (4) = 14.56, p = 0.002$), although math test scores did not correlate with grade ($r_s = -.03$). Students with ADHD were also more likely to be taking medication ($\chi 2(2) = 36.43, p < 0.001$), but within the group of students with ADHD, there was no difference in math test scores between those taking and those not taking medication ($t(59) = -.32, p > .05$). Students with ADHD were also more likely to indicate they had a learning disorder or another mental health diagnosis ($\chi 2(5) = 18.01, p = 0.003$).

Materials

Kentucky Online Testing program (KYOTE). The KYOTE is a math placement test used to place new college students into math classes appropriate for their achievement level and is part of a statewide college readiness program. The KYOTE items were generated by a 90-member team of mathematics faculty from Kentucky public and private universities, community and technical colleges, and state organizations such as Kentucky Adult Education (Newman, 2011). The test items have been shown to have good internal consistency (KR-20 = 0.85). Further, the KYOTE exam scores correlate with students' college algebra grades (University of Cincinnati, 2008). A paper version of this test was generated from the computer program and used in the present study.

Positive Affect Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS consists of 10 positive and 10 negative emotion adjectives rated on a 5-point Likert scale. The PANAS has been shown to have satisfactory internal consistency for the positive affect items ($\alpha = .89$) and the negative affect items ($\alpha = .85$). The PANAS also has satisfactory correlations with similar measures such as the Beck Depression Inventory and the STAI State Anxiety Scale. Scores are calculated by subtracting the total score of endorsed negative affect items endorsed from the total score of endorsed positive affect items.

State Self-Esteem Scale (SSES; Heatherton & Polivy, 1991). The 20 items on the SSES measure state self-esteem on a 5-point Likert scale. The SSES has been found to have internal consistency ($\alpha = .92$) and correlates with other measures such as the Multiple Affect Adjective Check List, the Self-Consciousness Scale, and the Trait Anxiety subscale of the STAI. Mean scores are calculated, with lower scores representing lower state self-esteem.

The PANAS and SSES were included following the findings of Inzlicht and Kang (2010) to measure and control for individual affect and any state self-esteem differences that followed the math test administration. These measures were collected in the present study to ensure that any differences between groups were not accounted for by individual affect or self-esteem differences.

Procedure

Participant data were collected in groups, where participants with and without ADHD were randomly assigned to one of two test conditions, either extended time or standard time, yielding a total of four conditions: students with ADHD with extended time (n = 30), students without ADHD with extended time (n = 37), students with ADHD with standard time (n = 31), and students without ADHD with standard time (n = 31). Testing sessions included only participants with ADHD or only participants without ADHD; the two populations were never tested in the same data collection session.

Students with and without ADHD were told they were taking a test to measure their mathematical ability. In the standard time conditions, participants were told they had the standard administration time available to complete the math test. In the extended time condition, participants were told they had twice the amount of time to complete the test than was offered in standard test administration and that this was the maximum amount of time offered. However, the participants in all groups were given the same amount of time (45 minutes).

Students with ADHD were told that the study was concerned with how well students with ADHD perform on a standard math test with the standard administration time (or extended administration time) available to complete the test. Students without ADHD were told that the study was concerned with how well students (removing ADHD from the script) performed on a standard math test with standard administration time (or extended administration time) available to complete the test. To encourage effort, the students were told, "Please give a strong effort in order to help us in our analysis of your mathematical ability when you complete this test with standard administration time" (or "when the time to complete the test is extended").

In each session, participants began the math test at the same time. The participants were instructed

to bring the completed math test to the researcher to receive and complete the additional measures. At that time, the researcher recorded the time each student spent completing the math test. The participants were then given a demographics questionnaire, the PANAS, and the SSES. Participants who were still working on the test 45 minutes after beginning were asked to turn in what they had completed and were then given the remaining measures to complete. Once participants completed all the measures, they were offered a debriefing form. All participants were treated in accordance with the Ethical Guidelines of the American Psychological Association.

Results

The number of math test items participants answered correctly was significantly correlated with SSES scores ($r = 0.39$, $p < .0001$) and the number of math classes the participants completed ($r = 0.21$, $p = 0.02$; see Table 1). This indicates that participants who performed better on the math test reported higher self-esteem and had completed more college math courses. PANAS scores were not significantly related to math test scores or completion time, which were also not significantly related to each other.

To follow up on the significant correlations, 2 X 2 between-groups (diagnostic status x testing condition) factorial analyses of variance (ANOVAs) using (1) SSES scores and (2) number of math courses completed as the dependent variables were conducted. With respect to SSES scores, there was a significant main effect of ADHD status (F (3, 125) = 4.83, $p = 0.02$), but not for testing condition (F (3, 125) = .58, $p = 0.45$), or for the interaction (F (3, 125) = 0.00, $p = 0.99$). Post-hoc Tukey's HSD tests for adjusted means indicated that students with ADHD reported significantly lower state self-esteem than students without ADHD. Means and standard deviations appear in Table 2. With respect to the number of math classes, neither main effect was significant, where $F_{\text{testing condition}}$ (3, 125) = 0.06, p = 0.80, and F_{ADHD} status (3, 125) = 0.24, p = 0.62. Additionally, the interaction was found to be non-significant (F (3, 125) = 0.07, p = 0.79). This indicates that the number of math courses taken was not significantly different across testing conditions or ADHD status.

To test the main prediction, a 2 X 2 between-groups (diagnostic status x testing condition) factorial analysis of covariance (ANCOVA) with SSES scores and the number of math courses entered as covariates, using math test scores as the dependent variable. The main effect of testing condition was not significant (F (5, 123)= 2.18, $p = 0.14$). Further, the interaction between testing condition and ADHD status was found to be non-significant (F (5, 123) = 0.69, $p = 0.41$). However, there was a significant main effect of ADHD status (F (5, 123) = 11.28, $p < .001$). Post-hoc Tukey's HSD tests for adjusted means indicated that participants with ADHD answered significantly fewer items correctly on the math test than participants who did not have ADHD (See Table 3). Further, a point-biserial correlation indicated that students on stimulant medications tended to make lower math scores ($r_{pb} = -0.19$, $p = 0.04$).

A 2 X 2 between-groups factorial ANOVA was used to investigate group differences in the amount of time taken by participants to complete the test. There was a significant main effect of ADHD status (F (3, 125) = 6.58, $p = 0.01$), but not for testing condition (F (3, 125) = .46, $p = 0.50$), nor the interaction (F (3, 125) = 0.23, $p = 0.63$). Post-hoc Tukey's HSD tests for adjusted means indicated that students with ADHD used significantly more time to complete the test than students without ADHD (See Table 4).

Discussion

It was hypothesized that students with ADHD would perform better on a math test when they were told they were receiving extended time to complete it. It was also predicted that students with ADHD who were told they were receiving standard time to complete the test would perform worse than students with and without ADHD who were told they were receiving extended time and students without ADHD who were told they were receiving standard administration time. However, the results of this study indicated that math test performance did not differ significantly across the test conditions, regardless of the students' diagnostic status. Therefore, telling students they were receiving extended or standard administration test time did not affect student test scores. This is inconsistent with previous research that demonstrates that all students improve when given extended time (Gregg & Nelson, 2010). The math test used in the present study was a college math placement test and, consequently, the items were fairly difficult. It is possible that because of test difficulty and because the test in the present study was not a "high stakes" test, the students' motivation was different than in previous research (only one student took the full time offered to take the test).

Table 1

Correlation Coefficients for Dependent Variables and Potential Covariates (N =129)

Dependent Variables	Potential Covariates			
	PANAS	SSES	Math Courses	Time Used
Test Score	0.16	0.39**	0.21*	0.15
Time Used	-0.04	0.12	0.10	--

Note. * p < .05, ** p < .001.

Table 2

Means and Standard Deviations for Variables of Interest as a Function of Group Membership

	ADHD				Non-ADHD			
	Extended *n* = 30		Standard *n* = 31		Extended *n = 37*		Standard *n = 31*	
Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Items Correct[a]	7.57_a	3.80	9.23_a	5.49	11.68_b	5.34	11.87_b	5.23
Math Courses	1.87	1.61	1.87	1.12	1.81	1.61	1.68	1.30
PANAS[b]	6.63	11.86	8.16	9.31	9.03	10.88	7.32	12.39
SSES[c]	3.47_a	0.72	3.35a	1.04	3.80_b	0.79	3.68_b	0.82

Note. [a]Maximum items correct is 25. [b]PANAS scores range from -34.00 to 36.00. [c]SSES scores reflect the mean of the items and range from 1.00 to 5.00. Means in the same row that do not share subscripts differ at $p < .05$.

Table 3

Unadjusted Mean Number of Correct Items on Math Test (with Standard Deviations in Parentheses) and Mean Adjusted for Test Completion Time and State Self-Esteem by Test Condition and ADHD Status

	Unadjusted		Adjusted	
Test Condition	ADHD	Non-ADHD	ADHD	Non-ADHD
Extended Time	7.57 (3.80)	11.68 (5.34)	7.77	11.24
Standard Time	9.23 (5.49)	11.87 (5.23)	9.65	11.77

Note. Maximum number of correct items on each test is 25.

Table 4

Mean Test Completion Time in Minutes for ADHD and non-ADHD Students as a Function of Test Condition

	ADHD $n = 61$		non-ADHD $n = 68$	
Test Condition	*M*	*SD*	*M*	*SD*
Extended Time	26.28_a	11.09	21.55_b	6.02
Standard Time	26.59_a	10.11	23.34_b	7.65

Note. Means that do not share subscripts differ at $p < .05$.

However, there were significant differences between the two student populations, students with and without ADHD, regardless of the testing condition. Students with ADHD were more likely to be taking stimulant medication for symptoms of inattention and were more likely to have other mental health diagnoses than students without ADHD. These results were expected, as students without ADHD are less likely to be prescribed and admit to using stimulant medication. Further, research has shown that it is not unusual for individuals with ADHD to have a wide range of comorbid mental health disorders (Kessler et al., 2006). While not surprising, and difficult to avoid, these differences between groups are limitations of the present study. Further, students with ADHD used more time to complete the math test and were more likely to be upperclassmen than students without ADHD, although neither of these variables was related to test performance.

On average, students with ADHD used 26.44 minutes to complete the test, well under the offered 45 minutes, whereas students without ADHD used an average of 22.45 minutes. Therefore, although students with ADHD, on average, used more time to complete the test than students without ADHD, neither group took full advantage of the time offered. It is possible that the students with ADHD may have benefited from other accommodations that were not available to them in the present study, such as testing in a private room or distraction-free environment. Lee et al. (2008) reported that students with ADHD expressed a preference for a distraction-free environment. Future research should focus on examining various accommodations and their impact on test performance.

Although state self-esteem was controlled for in the analyses, participants with ADHD indicated lower state self-esteem. This suggests that students with ADHD may be less confident in their ability to perform on a math test, which, in turn, could lead to poorer performance. Post-hoc analysis indicated that among students with ADHD, math test scores were correlated with state self-esteem ($r = .41$, $P < .01$). The exact nature of the relationship is unclear. It is not possible to determine whether low state self-esteem contributes to poorer performance or is a result of low math performance given the present data. It may be important for future researchers to try to tease apart the nature of this relationship. As Lovett (2011) pointed out, interventions for emotional or psychological factors affecting performance may also need to be a part of a comprehensive plan for assisting students with ADHD be successful.

There are some limitations to this study not previously mentioned. As some students with ADHD were taking stimulant medication to control their symptoms and others were not, the students were likely coping with varying symptom severity. Data regarding ADHD severity and the type of ADHD diagnosis were not collected or controlled for and this is a limitation of the study. Further, diagnosis documentation was not required by the researchers to participate in the study, rather, verification of disability status by the SDS office was deemed sufficient; however, this means that the diagnoses were made by different professionals and interrater reliability of these diagnoses cannot be demonstrated.

Based on the present study, extended time did not affect student performance, whether the students were diagnosed with ADHD or not. As previously proposed, the lack of significant improvement among those with extended time may be related to the nature of the test; that is, being for the purposes of the research study and not translating into personal gain or loss for the individual student. Students with ADHD scored lower on the test than those without the disorder, which is consistent with previous meta-analytic findings that students with learning disabilities underperform relative to those without learning disabilities, even with accommodations (Gregg & Nelson, 2010). Future research should investigate factors that enhance performance for students with specific disabilities. For example, it may be that providing different or multiple testing accommodations results in improved performance. Further, this research may help us better understand how testing accommodations function to increase test scores in all academic settings. By understanding how accommodations affect students, we can better adjust them in the future to meet the needs of students in appropriate ways.

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