

MeSA-IE Validity Research

Background

The MeSA-IE Test is based on the Trail Making Test that was originally part of the Army Individual Test Battery (1994). It consists of two parts and combined its two tests measure the mental processing speed, attention and mental flexibility. The MeSA-IE is a shortened version of the MeSA-AE test. The placement of the targets is the same, but there are only 15 targets in either Test A or Test B. The quotient scale scores for Test A and B are based on the total test completion time. Errors are immediately addressed by stopping test takers and requiring them to begin again at the last correct number or letter. Consequently, errors increase an individual's test score time.

Test A has been found in research to assess these cognitive abilities by using a complex visual scanning task (Schear and Sato, 1989). In Test B the subject has to connect number and letter sequences in an alternating pattern as quickly as they can. This subtest specifically requires divided attention. Test B is generally interpreted as a measure of executive functioning because it depends significantly on a person's working memory, attention and mental flexibility skills (Mitrushina, et al. 2005; Lezak and Howieson et al., 2012). Kelly (2000) confirmed that this test is a measure of components of executive functioning for children, as well. In this study the executive functioning skills of sustained attention, alternating attention and response inhibition were reflected in the improvements of 7 to 13 year olds on Test B.

Research studies clearly support that the MeSA-IE test is sensitive in identifying cognitive impairments of children resulting from brain damage (Lezak and Howieson et al., 2012; Reitan, 1971). In addition, this test for children is considered to be a good general measure of their attentional functioning (Baron, 2004). While the test is generally viewed as a non-specific measure of overall brain dysfunction (Lezak and Howieson et al., 2012) it has been found to be a useful measure of attention and executive functioning, as well as, psychometric processing speed (Mitrushina, 2005).

Test Construct Validity

The MeSA-IE Assist Test uses the same test format and procedures with only minor modifications to the instructions as the Trail Making Test. The positioning and arrangement of both the two practice tests and the two main tests were constructed to have the exact same layout as the Trail Making Test. By using the same format, the MeSA-IE Assist test inherently has face validity. Research using alternative test forms similar to the ones in the MeSA-IE Assist was also found to have strong reliability coefficients with the standard test layouts (Charter et al., 1987; Franzen et al. 1986) supporting their use.

Clinical Validity and Applications

The Trail Making test is widely used by many psychologists, because it has been found to be a valid measure of the effects and severity of traumatic brain injury (Armitage, 1946; Spreen and Benton, 1965). Lezak and Howieson et al., (2012) report that Test B has been found in several studies to be reflective of impairments in the left prefrontal cortex region. Lange and Iverson et al. (2005) in their research found that the test performance times increased proportionately based on the severity of the injury. An individual's performance on both tests was also found to significantly predict their level of independent functioning (M.B. Acker and Davis, 1989).

There are a number of other factors and disorders that are likely to result in higher test scores for both tests. Research has identified that individuals with emotional problems such as depression or more severe psychiatric disorders, including schizophrenia, are likely to show significant impairments on this test (Gass and Daniel, 1990; Crockett, Tallman, et al., 1988). Test errors were found to occur more often for individuals who had frontal lesions when compared to control subjects or individuals with posterior lesions (Stuss, Bisschop, et al., 2001).

The Spanish language version of the adult Trail Making Test was found to be valid for use with Hispanic populations using existing normative data criterion for evaluation of the test scores (Arnold, B.R., Montgomery, G.T. et al., 1994). While the interpretation of other neuropsychological tests was identified by these researchers to be biased for other ethnic populations, their findings do not support that this is likely to be true for the MeSA-IE test. Thus, both Swedish and Spanish versions of this test can be validly interpreted using the normative data provided.

In summary, there is a significant body of research that supports the validity of this test in assessing impairments in general cognitive functioning, attention and mental processing speed that are likely to impact a child's functioning in the home and school environments. In addition, lower test quotient scale scores were found to be significantly indicative of greater impairment in individual's functioning.

Demographic Effects

Strauss, Sherman and Spreen (2006) completed a review of the research pertaining to demographic and cultural differences for this test. Gender differences in numerous studies were not found to reveal significant sex-related differences for adults or children (Lezak and Howieson et al., 2012; Reitan, 1971). Slower score times were identified for Chinese-English bilingual and African American populations, but the primary relative differences in scores were found to be mostly attributable to the individual's age and secondarily to their education level. In general, these demographic variables were found to have less effect on test scores for clinical populations. Consequently, the MeSA-IE Test normative scoring system uses age based norms

and automatically adjusts the normative data set based on the person's education level, if available.

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Test Reliability

A number of research studies have been completed that evaluated the test-retest reliability of the Trail Making Test. Cohen, Paul et Al. (2001) reported finding significant correlations for Test A of .98 and for Test B of .67 for children. Strauss, Sherman and Spreen (2006) reported that the reliability of the Trail Making Test for children varied somewhat. In some studies with children Test A was found to be highly reliable and in others Test B. Consequently, examiners will need to make sure that children taking the test fully understand it and are motivated to perform well. The MeSA-IE can be easily restarted in cases where the examiner determines that the child is having some comprehension or motivation issues. In addition, alternative versions of the test can be used that will result in minimal practice effects in cases where the MeSA-IE needs to be re-administered during the testing time allotted. In general, the reliability of this test for use with children is considered sufficient to support its use in clinical assessments.

Noticeable practice effects do exist when individuals are re-tested after a relatively short interval such as a few days or a week. One study of adults by Stuss et al. (1988) found that on average for tests spaced one week apart that Test A decreased from two to six seconds (9% to 19% improvement depending on the age group) and that Test B decreased from six to ten seconds (12% improvement for two different age groups, but no significant change for one age group). One study involving adolescents by Barr (2003) supported that the test is a reliable measure of the cognitive skills that it assesses and has minimal practice effects that are likely to fall within a 90% confidence interval range. Thus, for the most part on retesting most individuals will not achieve decreases in their test completion time that reflect a meaningful change of their scores which cannot be reasonably accounted for by measurement error (Strauss, Sherman and Spreen, 2006).

Using Alternative Test Forms

Alternative forms of Test A and Test B have been found to have high correlation coefficients supporting their use. Charter et al. (1987) reported reliability coefficients for an alternative test that reversed the stimulus order ranging from .89 to .95 for Test A and from .92 to .94 for Test B. This study was completed using both normal and mix sample diagnostic groups. Overall, these reliability scores are equivalent to the scores obtained from the reliability studies using the original Tests A and B.

The design for developing alternative forms that has good reliability involves keeping the circle spatial layout the same, but rotating it either horizontally, vertically or in both directions. In this way the distance relationship between the various individual test stimuli is preserved.

Essentially, this means that alternative test forms will need to be created as “mirror-like images” of the original test in order to assure that they have face validity. The three alternative versions provided in the MeSA-IE Assist are labeled Alternative 1, 2 and 3 and they maintain the same original test layout but were flipped horizontally, vertically and both horizontally and vertically, respectively. Based on the existing body of research these alternative versions can be used reliably for retesting.

The value of using an alternative form is that it helps minimize practice effects when testing individuals for less than three months. Based on the research completed by McCaffrey et al. (1993) practice effects are best controlled for by the administration of the test a minimum of three months apart. This research found that all practice effects found from three preceding test administrations dissipated after three months’ time. In cases when it is necessary that the MeSA-IE Assist test be administered more frequently than three months one of the three alternative test versions can be used to minimize the known practice effects.