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The Multiple Intelligences Interest Inventory (MI3): Studies of Reliability and Validity

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Abstract

Preliminary analyses of reliability and validity of scores on the norm-referenced, 80-item Multiple Intelligences Interest Inventory (MI3) were conducted. The MI3 was designed to identify the intellectual interests and preferences of individuals aged 12 years and older in accord with Gardner's theory of multiple intelligences in order to help people identify and understand their relative, self-perceived areas of strength and challenge. Three independent samples of 2,866, 258, and 99 participants were used to explore the score reliability and internal (construct) and external (concurrent) facets of validity. Exploratory and confirmatory factor analysis indicated eight correlated factors that underlie the 80 item test as predicted by multiple intelligences theory, although the fit of the model to the data was marginal. Score reliability (α range of .80-.88) and concurrent validity (rs > .50) were more than adequate for screening level purposes.

Keywords: multiple intelligences; factor analysis; concurrent validity; reliability;

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1. Introduction

First introduced by Howard Gardner in 1983, the theory of multiple intelligences arose out of what Gardner thought was a gap in the way educators conceptualized intelligence. At the time, the prevailing theory was that a general intelligence existed, called the general intelligence factor (*g*), and could be deduced from testing individuals' cognitive abilities using IQ tests, the first of which was developed in the early 1900s by Alfred Binet (Denig, 2004; Gardner, 1999, 2006). Since that time, revisionist theories have emerged which view *g* as a central construct around which more specific factors converge (e.g., verbal comprehension, perceptual reasoning, processing speed, working memory)(Sattler, 2008), such as Wechsler's model, as displayed in the Wechsler Intelligence Scale for Children – 5th Edition (Wechsler, 2014) and Wechsler Adult Intelligence Scale – 4th Edition (Wechsler, 2008), and the Woodcock-Johnson IV Tests of Cognitive Abilities (Schrank, McGrew, & Mather, 2014). Gardner's theory of multiple intelligences (1999, 2006) comprises a more recent conceptualization of intelligence theory which rejects the existence of the general intelligence factor (*g*).

Gardner disagreed with the uniform view of intelligence, proposing that current standardized intelligence tests and definitions of intelligence were not taking into account all of the mental capabilities that constitute intelligence (Denig, 2004; Gardner, 1999, 2006). For example, modern intelligence tests focus predominately on test-takers linguistic, visual-spatial, and logical-mathematical skills to the exclusion of what Gardner believed was a rich array of additional intelligences (i.e., interpersonal, musical, bodily-kinesthetic, intrapersonal, and naturalist intelligences). Gardner asserted these other types of intelligence were as important as the intelligences already being tested. In addition, Gardner was concerned that schools educating students from Pre-kindergarten through grade 12 and universities that used curricula appealing to this general intelligence benefitted select students and was unfair to most students. Accordingly, when Gardner developed his theory of multiple intelligences, his aim was to incorporate areas of thinking and problem solving that had previously been studied within the field of psychology, but not necessarily incorporated into modern tests of intelligence (Chen, 2004; Gardner, 1999, 2006).

In creating his theory, Gardner (1999) defined intelligence as "a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (pp. 33-34). Essentially, all human beings have potentials in each of Gardner's eight intelligences, which are described in Table 1. However, some intelligences develop more strongly in different individuals and depend on a complex interplay of heredity, cultural values, familial values, and whether the individual is given the chance to hone, refine, and master various skill-sets (Gardner, 1999, 2006).

Table 1. A Summary of Gardner's Multiple Intelligence.

Intelligence	Description	Related Occupation
Linguistic	The ability to discern nuances of language and the capacity to use (through writing or speaking) to meet objectives. Core capabilities: knowledge and understanding of semantics, syntax, phonology, and pragmatics	Author, journalist, poet, public speaker
Logical-Mathematical	The ability to solve problems, think logically, recognize mathematical symbols, perform mathematical operations, use abstraction, and understand and create patterns	Mathematician, scientist, logician, engineer, accountant
Musical	The ability to translate human emotion into sound. Adeptness to pitch, rhythm, and timbre. Proficiency in performance and composition.	Musician, composer, singer, conductor
Spatial	The ability to observe and manipulate objects, forms, and elements. The ability to recognize objects, forms or elements when they have been transformed. The capacity to translate objects in the physical	Painter, sculptor, pilot, graphic designer, surgeon, architect

	world or a person's mind into a product.	
Bodily-Kinesthetic	The ability to use the body or parts of the body in controlled, specific ways for the purpose of meeting certain goals (e.g., creating a product, winning a competition, fixing a problem)	Dancer, athlete, mime, contortionist, builder, actor, mechanic
Interpersonal	The ability to read the emotions, motivations, and goals of others and then use that knowledge to interact effectively with or help those individuals	Helping professional, politician, salesperson, teacher
Intrapersonal	The ability to understand one's own emotions, the roots of those emotions, and how to use those emotions in a constructive and productive way. The ability to recognize one's own wants, needs, desires, fears, strengths, and weaknesses and use that information to lead a successful life.	Helping professional, philosopher, novelist
Naturalist	The ability to recognize and differentiate among various species of animals, plants, flowers, and trees.	Scientist, farmer, hunter, farmer, environmentalist

Although the theory of multiple intelligences has existed for over two decades, no performance and ability tests have been developed to measure actual demonstrated skills in the areas of multiple intelligences, such as are used to measure traditional intelligence abilities. And only a few tests have been developed to assess individuals' interests, strengths, and weaknesses with regard to Gardner's eight intelligences. A host of web-based occupational interest tests and quizzes on the subject can be found by conducting a simple Internet search. However, these tests have not undergone the rigorous development process necessary to ensure reliability and validity of scores or provide consumers with confidence in the accuracy of results that would allow them to make meaningful decisions about their lives. Two published measures of multiple intelligence preferences constructed to date are the Teele Inventory of Multiple Intelligences (TIMI; Teele, 1992) and the Multiple Intelligences Developmental Assessment System (MIDAS; Shearer, 2007). The TIMI uses a panda bear picture-based theme and is most appropriate for use with young children. The MIDAS has versions for administration to adolescents and adults. Neither the TIMI nor MIDAS has been norm-referenced. Related career interest inventories, such as the Strong Interest Inventory, have also been developed to measure self-perceived cognitive and vocational preferences, although these instruments are not aligned with Gardner's multiple intelligences theory.

This article presents the results of the development of a new instrument, the Multiple Intelligences Interest Inventory (MI^3), a norm-referenced assessment designed to measure the self-reported intellectual interests of individuals 12 years of age and older in accord with Gardner's eight intelligences. Importantly, the MI^3 is a self-report screening inventory, rather than a task-oriented ability or intelligence test. Thus, it serves as a "proxy" for an actual ability assessment, rather than a performance-based test of intellectual potential or fully acquired skills. Being the first available norm-referenced assessment of intellectual interests, it could help examinees understand their relative strengths and weaknesses with regard to intellectual interests and preferences.

The studies that follow include preliminary results of reliability and validity of self-report responses. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to examine the number of dimensions which underlie the 80 MI^3 items. Since Gardner proposed eight intelligences and eight rationally determined subscale scores are interpreted for the MI^3, an eight factor structure was predicted.

2. Method

Three independent samples were used in the following three studies. Participants were volunteers recruited as samples of convenience through schools and networks of colleagues from primarily urban/suburban settings of several Mid-Atlantic states. Guidelines for approval of human subjects study were followed and informed consent was obtained. Minor-status participants were recruited from public and private schools and provided assent, while their parents/guardians provided formal consent for them to participate. Adolescents and adults were used in these samples because of their ability to understand and evaluate self-perceived interests. They were recruited through calls for participation in middle schools, high schools, and universities. Relatives of students were encouraged to participate in order to obtain a large adult population.

2.1. Participants

Study 1. Participants were 2,866 individuals (1,109 males [38.7%], 1,757 females [61.3%]) ages 12-90 years (*M* = 29.1; *SD* = 14.4; *Mdn* = 25)(326 participants 12-14 years; 567 participants 15-18 years; 314 participants 19-22 years; 472 participants 23-29 years; 405 participants 30-39 years; 334 participants 40-49 years; 293 participants 50-65 years; and 55 participants 65 years or older). Participation in the study was voluntary. Of the participants, 78.6% were White, 14.9% African American, 2.3% Asian American, and 4.2% "other."

Study 2. Participants were 258 individuals (76 males [29.5%], 182 females [70.5%]) aged 12-72 years (*M* = 32.6; SD = 13.4; *Mdn* = 28 years). About 72.1% of the participants were White, 21.7% African American, 2.3% Asian American, and 3.9% "other."

Study 3. Participants were 99 individuals (41 males, 48 females) ages 17-34 years (*M* = 22.1; *SD* = 3.4; *Mdn* = 21 years). Of the participants, 73% were White, 17% African American, 4% Asian American and 6% "other."

2.2. *Instruments*

Multiple Intelligences Interest Inventory (MI^3). The Multiple Intelligences Interest Inventory (MI^3) can be individually or group administered in a paper and pencil format in about 10 minutes and scored in less than five minutes. The MI^3 consists of 80 brief items measuring self-perceived cognitive interests, rather than objectively measured cognitive skills or abilities. In each section, ten items were derived for each of eight subscales designed to align with the eight multiple intelligences identified by Gardner (1999): (1) linguistic, (2) logical-mathematical, (3) spatial, (4) kinesthetic, (5) musical, (6) interpersonal, (7) intrapersonal, and (8) naturalist. Respondent instructions written at the top of the protocol stated: "Please circle the numbers below to rate how INTERESTED you are in the following activities according to the following scale:" Each item is rated on a four-point scale (i.e., 0, 1, 2, or 3) where: 0 = "I am NOT AT ALL interested in the activity"; 1 = "I am A LITTLE or OCCASIONALLY interested in the activity"; 2 = "I am FREQUENTLY or OFTEN interested in the activity"; and 3 = "I am VERY FREQUENTLY or VERY OFTEN interested in the activity." Raw scores for each subscale are determined by simple sum of scores procedures and can be interpreted as relative raw score values or converted into percentile ranks for norm-referenced interpretation. Prior to this study, no evidence of score reliability or validity was available.

MI Inventory for Adults (Armstrong, 1993). The MI Inventory for Adults was published in the book, *7 Kinds of Smart*, by Armstrong (1993) and no norms or data on score reliability or validity have been provided. The inventory consists of 70 items, ten for each of the seven intelligences identified by Gardner at that time in the early 1990s: (a) Linguistic Intelligence; (b) Logical-Mathematical Intelligence; (c) Spatial Intelligence; (d) Bodily-Kinesthetic Intelligence; (e) Musical Intelligence; (f) Interpersonal Intelligence; and (g) Intrapersonal Intelligence. The administration format is paper and pencil, either to individuals or groups of individuals. Examinees respond to each item by placing a check mark in the answer space to indicate their preferences. Subscale raw scores are computed using a simple tally of checkmarks; thus raw scores for each subscale can range from 0-10. Interpretation procedures for subscale raw scores are absent, except to indicate that a greater number of checkmarks in a given category indicates a greater expressed interest in that category of intelligence.

2.3. Procedure

Study 1. Participants were administered the MI^3 according to standardization specifications using an individual paper and pencil format. Computation of internal consistency coefficients (Coefficient alpha) for the total sample was performed, while exploratory factor analysis (EFA) and confirmatory factor analysis using Mplus maximum likelihood estimation procedures were conducted, each on one-half of the study 1 sample, assigned randomly to two subsamples.

Study 2. The MI^3 was administered to the 258 participants, and then administered again after exactly 14 days. All protocols were scored according to standardization specifications and subscale standard scores for each administration were used to compute test-retest Pearson correlation coefficients.

Study 3. Convergent validity was explored using correlations between scores on the MI^3 subscales and subscales of the MI Inventory for Adults instrument developed by Armstrong (1993) purporting to measure similar constructs. The MI^3 and MI Inventory for Adults were administered to participants in two differently ordered configurations and these were randomly distributed to research participants. All protocols were scored according to standardization specifications and subscale standard scores were used to compute Pearson correlation coefficients.

3. Results

3.1. Factorial Validity

EFA was conducted on a randomized selection of one-half of the responses from the study 1 sample (n = 1,433). EFA of responses was conducted using Mplus version 5.21 (Muthen & Muthen, 2007). Eigenvalues of 15.83, 7.48, 3.85, 3.21, 2.82, 2.14, 1.82, 1.60, 1.43, 1.29, 1.24, 1.13, 1.06, 1.05, and 1.01 were initially obtained, which were associated with unrotated factors and exceeding the 1.00 criterion. Scree and parallel analyses (Dimitrov, 2008a, 2008b) suggested extractions of five through nine factors, all using maximum likelihood estimation and an oblique geomin rotation because factors were assumed to be intercorrelated. A factor structure coefficient of .30 (nine percent of variance in common between a variable and a factor) and above was considered salient for the interpretation of variable-factor correlations (Tabachnick & Fidell, 2013).

The eight-factor extraction accounted for 48.9% of the variance among item responses and yielded the most interpretable and parsimonious result. The fit statistics generated by Mplus accompanying the EFA procedure included a significant chi-square ($\chi^2(3052) = 20808.89$; $p < .05$), root mean square error of approximation (RMSEA) = .057 (90% CI = .0505-.052; p = .088), and standardized root mean square residual (SRMR) = .033. Dimitrov (2008a, 2008b) suggested that the chi-square of a good fitting model would not be significant ($p > .05$), and that RMSEA$\leq$.06 and SRMR$\leq$.08 indicate a reasonable fit. In this case, the output statistics for chi-square indicated a poor fit of the six-factor model to the subsample 1 data, while RMSEA and SRMR indicated an adequate fit.

Confirmatory factor analysis (CFA) was conducted on scores for the participants in subsample 2 (*n* = 1,433) using the Mplus version 5.21 (Muthen & Muthen, 2007) CFA procedures to determine how well the six-factor model fit a cross-validation sample of participant scores. This time the output statistics generated by Mplus 5.21 indicated a significant chi-square ($\chi^2(3065) = 21,922.36$; $p<.05$), comparative fit index (CFI) = .81, RMSEA = .060 (90% CI = .059-.062), and SRMR = .070, again indicating a marginal fit of the 8-factor model to the data from subsample 2, although the RMSEA and SRMR were within the acceptable range for a good fitting model. Dimitrov (2008a, 2008b) suggested that a CFI of $\geq$ .90 indicated adequate model fit. Interestingly, the 8-factor model, analyzed using Mplus 5.21 CFA procedures on the same cross-validation sample provided virtually the same fit statistics as the 8-factor model (CFI = .80; RMSEA = .060; SRMR = .072). Cheung and Rensuold (2002) indicated that a change in CFI of >.01 was a significant improvement in fit. Still, both models were far from optimal model fits as neither model adequately explained the fit of the data. Raw sores and conversions to percentile ranks for the MI^3 subscales by sex and age categories are available from the lead author upon request. Interscale correlations are presented in Table 2.

Specificity refers to the unique contribution of subscale scores after error variance is removed. This variance specific to the test is computed by subtracting the communality of a set of items from the test-retest reliability coefficient of that set of items (Sattler, 2008). Specificities for the eight rational subscales built into the MI^3 are: .30 for linguistic, .22 for logical-mathematical, .15 for spatial, .27 for kinesthetic, .51 for musical, .19 for interpersonal, .19 for intrapersonal, and .49 for naturalist intelligences.

3.2. Reliability

Internal consistency (α) coefficients of scores on the eight rationally derived subscales of the MI^3 for the total sample used in Study 1 ranged from .80-.88. The 14-day test-retest reliability (Pearson) coefficients ranged from .76-.83), while coefficients alpha for the initial test ranged from .77-.89 and .77-90 for scores on the retest for the sample used in Study 2. Overall, participants' responses to the MI^3 items were reliable both in terms of internal consistency and test-retest stability for screening level purposes.

3.3. Concurrent Validity

Concurrent validation of the MI^3 involved the calculation of Pearson correlations between the raw scores of subscales of the MI^3 and Armstrong's (1993) adult MI scale. These results are presented in Table 2. The MI^3 subscales displayed moderate correlations (r = .56-.63) with all predicted criterion measures indicating acceptable convergent validity.

Table 2. Interscale Correlations for Sample 1 Responses and Concurrent Validity Coefficients for Comparison of MIT Subscales and Subscales of the MI Test for Adults (Armstrong, 1993).

Subscale (Number) Name	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)Linguistic	---							
(2)Logical-mathematical	.25	---						
(3)Spatial	.17	.75	---					
(4)Kinesthetic	.07*	.57	.69	---				
(5)Musical	.30	.33	.35	.38	---			
(6)Interpersonal	.61	.25	.27	.29	.38	---		
(7)Intrapersonal	.63	.21	.21	.17	.39	.69	---	
(8)Naturalist	.39	.32	.37	.34	.36	.46	.45	---
Linguistic	MI Inventory for Adults (Armstrong, 1993)							
Logical-Mathematical	**.58**	.20	.11*	.05*	.25	.49	.51	.31
Spatial	.22	**.63**	.63	.48	.26	.15*	.12*	.19*
Bodily-Kinesthetic	.14*	.58	**.62**	.52	.27	.17*	.14*	.27
Musical	.07*	.44	.51	**.59**	.31	.20	.11*	.24
Interpersonal	.28	.23	.33	.27	**.61**	.30	.29	.26
Intrapersonal	.47	.18*	.19*	.18*	.32	**.56**	.56	.34
	.47	.17*	.17*	.10*	.31	.50	**.57**	.40

Note: MI^3 intrascale coefficients n = 2,866; MI3 and Armstrong interscale correlations n = 99; all correlations were significant at $p < .05$, except *; Bolded coefficients indicate expected moderate concurrent validity coefficients.

4. Discussion

These studies represent the initial steps in the development of a screening test that can be used to efficiently identify the self-perceived learning interests and strengths of older school-aged students (ages 12 years and older), college students, and adults. An understanding of learning strengths and challenges can help instructors modify lessons and allow students to use learning modalities of strength to demonstrate mastery of learning. An understanding of cognitive interests also could someday help students, adults, educators, and counselors determine competencies leading to enhanced educational planning and career exploration services. The findings of these preliminary studies investigating item reliability and validity suggest the MI^3 is a psychometrically adequate screening tool to help identify self-perceived intellectual interests.

Reliability of scores on the MI^3 was determined through studies of internal consistency and test-retest stability and all subscales displayed at least adequate levels of score reliability for screening level purposes. Thus, the predetermined design of ten items per subscale appears to allow acceptable score reliability.

Construct validity of the MI^3 was explored through three procedures: (a) concurrent validity as determined by correlating scores on the MI^3 with another test that also purportedly measures intellectual interests (Armstrong, 1993), (b) specificity indexes, and (c) studies of exploratory and confirmatory factorial validity. Moderate correlations (r = .56-.63) were noted between expected subscales of the MI^3 and Armstrong's MI Test for Adults. Moderate correlations are highly desirable between criterion measures; low correlations indicate a lack of convergent validity, while high correlations indicate the constructs measured are too highly overlapping, measuring the same thing on an alternate measure. In instances of high correlations, advantages of the new measure must be evident; otherwise legitimate criticisms emerge over the construction of a second, highly related, but unnecessary version of the test. The MI^3 measures self-perceived interests and preferences so a next logical step in the development of this instrument would be to explore whether scores on dimensions of the MI^3 correlate with similar domains as measured by ability or performance measures. High correlations may demonstrate a potential bridge between interests and competencies in the eight areas proposed by Gardner.

In Table 2 it is also important to note that a number of derived coefficients also provide evidence of discriminant validity, which involves low correlations between theoretically unrelated or independent constructs. For example, low correlations were noted between the MI^3 Linguistic intelligence subscale and the Logical-Mathematical, Spatial, and Bodily-Kinesthetic intelligence subscales. Because linguistic ability is theoretically unrelated to these three other intelligences, low correlations were anticipated and observed.

Specificity estimates the amount of variance specific to a factor, once the communality of factor loadings is removed from the true score variance (as indicated by a scale's test-retest correlation). Specificity indexes for the eight MI^3 subscales ranged from .15-.49 indicating that each MI^3 subscale contributes unique variance to our measurement of intellectual interests.

A somewhat surprising result was that the hypothesized eight-factor model did not fit the cross-validation sample data very well (CFI = .81), consistent with the CFA solution (CFI = .80). It is important to understand that this statistical observation results from the MI^3 items and the data collected for this study, rather than necessarily a reflection of the theory itself. Gardner (1999, 2006) proposed eight intelligences and eight rationally derived subscales were constructed to underlie the 80 items on the MI^3 during the EFA study. Not surprisingly, the items comprising the Logical-Mathematical, Spatial

Intelligence, Musical Intelligence, and Naturalist Intelligence scales emerged in an expected pure form. Only six of the ten Bodily-Kinesthetic Intelligence items loaded on Factor 5, while the other four items correlated to a significant degree with Factor 1 (Spatial Intelligence). Future item development will need to address these four items to provide a clearer, more independent estimate of bodily-kinesthetic interests.

The most intriguing result was that three rationally derived subscales (i.e., Linguistic Intelligence, Interpersonal Intelligence, and Intrapersonal Intelligence) were highly correlated. From Table 2, one can see the correlations between these three rationally-derived subscales ranged from .61-.63. Thus, even though Gardner (1999) viewed each intelligence as independent or distinct from the others, in the empirical sense a number of the intelligences appear highly related. Of course, the results of these studies speak more specifically to the items comprising this MI^3 than to the actual theory as proposed by Gardner which the items were designed to represent.

4.1. Limitations and implications: Next Steps

While these results appear promising, several limitations and cautions must be noted. A limitation was use of an unnormed instrument as the criterion measure in this study. Even though the MI Inventory for Adults (Armstrong, 1993) is widely used, neither it, the TIMI, or the MIDAS were norm-referenced. Indeed, the rationale for developing the MI^3 was to create a norm-referenced instrument to measure intellectual interests. Hess (2005) and Kuhlenschmidt (2005) indicated that the TIMI was more appropriate for young children, so was not a good fit for the adolescent and adult sample from this study. Hitonsmith (2007) and Schneider (2007) praised the MIDAS on several psychometric issues and further study of the MI^3 should use the MIDAS as a convergent criterion. Even though the Armstrong measure was designed for use with adults, it is commonly used with adolescent populations and, thus, was a reasonable choice for a criterion in this instance. Additional study of convergent validity should explore the correlations between MI^3 subscales and performance measures and ability tests that directly assess an individual's ability in the multiple intelligences proposed by Gardner. Further study of the MI^3 should also use independent, divergent measures to confirm that MI^3 subscales display low correlations with theoretically unrelated measures.

Another limitation involves caution in generalization of validity results from any newly designed instrument. Replication studies and studies expanding use of the MI^3 to other, more diverse samples are needed. Now that the factor analytic results from this study are known, additional item changes can be made to enhance factor stability and validity. This is particularly important for the four Bodily-Kinesthetic items that loaded on the Spatial Intelligence factor. In addition, a number of items displayed substantial cross-loadings and may require revision in order to become more closely aligned with the dimension each item was originally designed to measure. While some cross loading was expected because the hypothesized dimensions were believed to be correlated rather than orthogonal, cross loading to this degree was unexpected and may warrant further item revision. A logical next step is to conduct more confirmatory factor analytic (CFA) studies and associated cross-validation studies on diverse samples of respondents.

A logical application for MI theory involves integration into the educational planning of middle and high school students and the career planning process for adolescents and adults. In some ways, the multiple intelligences typology shares a similarity with Holland's vocational typology (Holland, 1985), which assesses and describes client interests and competencies in terms of six personality types: Realistic (manual and mechanical skills); Investigative (analytical, technical, scientific skills); Artistic (creative ability, emotional expression); Social (interpersonal competencies, skill in teaching, treating or healing); Enterprising (skill in persuading others or getting others to do things); and Conventional (clerical skills, meeting precise standards of performance).

While the typology of multiple intelligences described by Gardner (1999, 2006) is certainly distinct from Holland's (1985) typology in many ways, some rational overlap does occur. For example, Holland's Artistic type shares some commonalities with Gardner's musical and spatial intelligences;

Holland's Social type aligns with Gardner's interpersonal intelligence; and Holland's Investigative type overlaps with Gardner's logical-mathematical intelligence. It is possible that deeper exploration of these connections could lead to more effective educational planning services by professional school counselors, and career planning and counseling by career counselors. That is, application of MI theory to educational and career planning may complement traditional career approaches, such as Holland's career typology (Holland, 1985), Super's (1990) life-space, lifespan developmental career theory, Krumboltz's (1996) social learning career theory, and Savickas' (2005) career construction theory, as another way of understanding the individual strengths and interests of a developing individual. As such, MI theory may display advantages in predicting a course of study the student is more likely to excel in, given strengths and interests on the various intelligences. Additional studies of the MI^3 should determine the degree to which various subscales predict academic success in high school and various programs of study at the university level.

These preliminary studies provide important data regarding the MI^3. Replication and further study may lead to the consistent and useful multifaceted evidence necessary for effective use of the screening instrument. This preliminary evidence suggests the MI3 may have practical implications for educators involved in ensuring the academic and career success of students. The MI3 appears to provide an effective, quick way of determining student or adult strengths and challenges regarding intellectual interests and competencies. Requiring 10-15 minutes to administer and score, the MI3 may prove to be an attractive, easy to use tool for school-based practitioners. With many schools facing time and personnel shortages, screening tools that are the least demanding on teacher instructional and planning time are most valuable. With further development and study, the MI3 may become a screening tool that not only yields consistent and useful scores, but also play an important role in the appropriate and effective screening of student or adult self-perceived intellectual interests.

References

Armstrong, T. (1993). 7 kinds of smart. New York, NY: Penguin Books.

Chen, J-Q. (2004). Theory of multiple intelligences: Is it a scientific theory? *Teachers College Record, 106*, 17-23.

Cheung, G. W. & Rensvold, R. B. (2002). Evaluating goodness of fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255.

Denig, S. J. (2004). Multiple intelligences and learning styles: Two complementary dimensions. *Teachers College Record, 106,* 96-111.

Dimitrov, D. (2008a). Factor analysis and other multivariate methods. In B. T. Erford (Ed.), *Research and evaluation in counseling* (pp. 509-523). Boston, MA: Houghton Mifflin / Lahaska Press.

Dimitrov, D. (2008b**).** *Quantitative research in education: Intermediate & advanced methods***.** Oceanside, NY: Whittier Publications.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York, NY: Basic Books.

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. New York, NY: Basic Books.

Gardner, H. (2006). *Multiple intelligence: New horizons*. New York, NY: Basic Books.

Hess, K. A. (2005). Review of the *Teele Inventory for Multiple Intelligences*. In R. A. Spies, & B. S. Plake (Eds.), *The sixteenth mental measurements yearbook* (pp. 1011-1012). Lincoln, NE: University of Nebraska Press.

Hiltonsmith, R. W. (2007). Review of the *MIDAS: The Multiple Intelligences Developmental Assessment Scales [Revised]*. In K. F. Geisinger, R. A. Spies, J. F. Carlson, & B. S. Plake (Eds.), *The seventeenth mental measurements yearbook* (pp. 532-534). Lincoln, NE: University of Nebraska Press

Holland, J. L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall, Inc. Krumboltz, J. D. (1996). A learning theory of career counseling. In M. Savickas, & B. Walsh (Eds.), *Integrating career theory and practice* (pp. 233-280), Palo Alto, CA: CPP Books.

Kuhlenschmidt, S. (2005). Review of the *Teele Inventory for Multiple Intelligences*. In R. A. Spies & B. S. Plake (Eds.), *The sixteenth mental measurements yearbook* (pp. 1013-1014). Lincoln, NE: University of Nebraska Press

Muthen, L., & Muthen, B. (2007). *Mplus Version 5 user's guide.* Los Angeles, CA: Authors.

Sattler, J. M. (2008). *Assessment of children: Cognitive foundations* (5th ed.). La Mesa, CA: Author.

Savickas, M. L. (2005). The theory and practice of career construction. In R. W. Lent, & S. D. Brown (Eds*.), Career development and counseling: Putting theory and research to work* (pp. 42-70). Hoboken, NJ: John Wiley & Sons.

Schneider, W. J. (2007). Review of the *MIDAS: The Multiple Intelligences Developmental Assessment Scales [Revised]*. In K. F. Geisinger, R. A. Spies, J. F. Carlson, & B. S. Plake (Eds.), *The seventeenth mental measurements yearbook* (pp. 534-537). Lincoln, NE: University of Nebraska Press.

Schrank, F. A., McGrew, K., & Mather, N. (2014). *Woodcock-Johnson IV Tests of Cognitive Abilities.* Itasca, IL: Riverside Publishing.

Shearer, C. B. (2007). *The MIDAS: Professional manual* (revised edition). Kent, OH: Multiple Intelligences Research and Consulting, Inc.

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown, L. Brown, & Associates (Eds.), *Career choice and development: Applying contemporary theories to practice* (2nd ed.)(pp. 197-261). San Francisco, CA: Jossey Bass.

Tabachnick, B. G. & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed*.).* New York, NY: Harper & Row.

Teele, S. (1992). *Teele Inventory for Multiple Intelligences* (TIMI). Redlands, CA: Sue Teele & Associates. Wechsler, D. (2008). *Manual for the Wechsler Adult Intelligence Scale* (4th ed.). San Antonio, TX: Psychological Corporation.

Wechsler, D. (2014). *Manual for the Wechsler Intelligence Scale for Children* (4th ed.). San Antonio, TX: Psychological Corporation.