9-1-2012

Modified Administration of the WAIS-IV for Visually Impaired Examiners: A Validity Study

Amy Pitchforth
Loma Linda University

LOMA LINDA UNIVERSITY
School of Behavioral Health
in conjunction with the
Faculty of Graduate Studies

Modified Administration of the WAIS-IV for Visually Impaired Examiners: A Validity Study

by

Amy Pitchforth

A Dissertation submitted in partial satisfaction of
the requirements for the degree
Doctor of Philosophy in Psychology

September 2012

Each person whose signature appears below certifies that this dissertation in his/her opinion is adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.

_____, Chairperson
Susan Ropacki, Associate Professor of Psychology

_____
Kendal Boyd, Associate Professor of Psychology

_____
Elizabeth Jaworsk, Director of Services to Students with Disabilities, California State University, San Bernardino

_____
David Vermeersch, Associate Professor of Psychology

ACKNOWLEDGEMENTS

It is the hard work of my dissertation chair, committee, and research assistants that I both acknowledge and thank. Additionally, the Colton Unified School District was both generous and support as a staff in their willingness to participate in my study. I also thank my family for their creativity and endless support in the creation and completion of my dissertation.

CONTENT

TABLES

Tables Page

ABSTRACT OF THE DISSERTATION

Modified Administration of the WAIS-IV for Visually Impaired Examiners: A Validity Study

by

Amy Pitchforth

Doctor of Philosophy, Graduate Program in Psychology
Loma Linda University, September 2012
Susan Ropacki, Chairperson

Opportunities in all areas of life including education, vocation, and access to general information have historically been slower for minorities. The visually impaired have continued to struggle with access to education, equal opportunities at work, and access to general information. Significantly fewer blind and visually impaired individuals pursue graduate education with the most commonly pursued graduate degree being psychology (American Federation for the Blind, 2010). A core area of graduate training [defined by the American Psychological Association (APA)] is declarative knowledge, which is not accessible for the visually impaired student for neurological assessments (Johnson-Greene, Braden, Dial, Fitzpatrick, Leung, Schneider, & Willis, 2007). The same 27 participants (all with at least 19 years of education) were given both the standardized and the modified WAIS-IV. Participants scored significantly lower on the full scale IQ, the verbal comprehension index, and the processing speed index of the modified version. Validity of the modified WAIS-IV was assessed by comparing the correlation between it and the WIAT-II and the correlation between the standardized WAIS-IV and the WIAT-II. Despite the significant differences between the modified and standardized WAIS-IV, the standardized WAIS-IV and the WIAT-II, suggesting the modified WAIS-IV is a valid

intellectual assessment instrument. The differences between the modified WAIS-IV and the standardized WAIS-IV can be accounted for by three predominate factors: the modifications of the block design and symbol search subtests, the multiple examiners that both administered and scored the WAIS-IV, and potential practice effects resulting from the high level of education of the participants. These findings suggest that the modified WAIS-IV should be further explored as a viable assessment option for visually impaired examiners due to the similarities found between the standardized and modified versions. These findings also highlight exciting potential opportunities for the field as a whole and more specifically for the visually impaired psychology doctoral student and professional psychologist.

CHAPTER ONE

INTRODUCTION

Difficulties Related to Access for Those with Disabilities

Opportunities in all areas of life including education, vocation, and access to general information have historically been slower for minorities. Minorities that have continued to struggle with access to education, equal opportunities at work, and access to general information and locations are individuals with disabilities. The government did not get formally involved with protecting and advocating for the rights of the disabled until 1973 when the Rehabilitation Act was passed and then in 1984, when the Americans with Disabilities Act was passed. The disability rights movement, over the last couple of decades, has made the injustices faced by people with disabilities visible to the American public and to politicians. This required reversing the centuries-long history of "out of sight, out of mind" that the segregation of disabled people served to promote (Mayerson, 1992).

This struggle to be accepted and successful in mainstream society has been just as difficult for the blind and visually impaired. It has taken over twenty years since the Americans with Disabilities Act for the blind and visually impaired to have even the opportunity to display their ability to perform job duties in professions of choice. Many of these fields require specific training and higher education. The American Federation for the Blind, which is an organization for the blind and visually impaired, has created an on-line network of professionals who are visually impaired called Career Connect. These individuals serve as mentors for other visually impaired individuals looking to start or change careers, and looking for some advice or guidance. Within these networks of blind

or visually impaired professionals, it was found that close to thirty percent of network members pursued a career in psychology or counseling. All of these individuals are currently holding a position that required them to obtain a graduate level degree in psychology or related field (American Foundation for the Blind, 2010).

Training Considerations for the Psychology Student with a Visual Impairment

Of these blind individuals from the online networks, over fifty percent of them went on to pursue a doctoral degree in clinical or counseling psychology. Speaking in broad terms and using the criteria posted by the American Psychological Association (APA), a doctoral program in clinical or counseling psychology includes several components (APA, 2010). The sought after aims of these programs are to provide broad and general preparation for entry-level practice. This is done through focused and in-depth preparation for specific areas, and an integration of science and practice. This is outlined by APA as the inclusion of courses that cover the breadth of scientific psychology, foundations of practice in the program's substantive areas, diagnosing or defining problems through assessment and implementing intervention strategies, issues of culture and diversity, and the essential attitudes for life-long learning (APA, 2010).

Since declarative knowledge is considered one of the core competencies in psychology, and is included on licensing exams, graduate psychology training programs are required to teach declarative knowledge across subject areas, including assessment (Johnson-Greene, Braden, Dial, Fitzpatrick, Leung, Schneider, & Willis, 2007). The exposure to declarative knowledge is provided to the student regardless of their goals and

intentions of including assessment in their career. However, operational knowledge of various assessment tools and instruments is not always required or taught in training programs. In fact, there is a lack of specification and thus consistency in how "diagnosing or defining problems through assessment" may take place in a practical, operational sense (if at all). In a program in which operational knowledge is required, the student learns and practices planning, administration, scoring, and interpretation of cognitive, personality, and/or projective assessments.

APA clearly states that a training program is to avoid any actions that would restrict program access on grounds that are irrelevant to internship training or a successful career in psychology (APA, 2007). Therefore, all students are to be afforded declarative knowledge in assessment. This is further supported for individuals with visual impairments by the Americans with Disabilities Act (ADA), which is an anti discrimination law that protects persons with disabilities in education, work, leisure, travel and communications. The ADA states that postsecondary institutions are responsible for providing and bearing the cost of reasonable and necessary accommodations when a student declares a disability. An accommodation does not compromise the essential elements of a course or curriculum, nor may it weaken the academic standards or integrity of a course. Accommodations simply provide a modified pathway to accomplish the course requirements by eliminating or reducing disability-related barriers (APA, 2010). An example of a reasonable accommodation for a student with a visual impairment could be providing or modifying equipment (e.g., the use of a computer for note or test taking), or providing auxiliary aids and services (e.g., mobility training to learn a practicum or training facility). When considered in the context of

operational training with assessment tools, this particular conflict between training and accommodation becomes apparent.

Historically, most assessments have been designed by and for examiners who do not have a visual or any other disability. This has presented two major barriers for students with visual impairments in the ascertainment of declarative and operational knowledge of assessments. The first barrier applies to all assessments, and this is the students' ability to access the manuals and test materials in a usable format (i.e., electronic format, Braille, or audio format). With the advancement in technology, the student has some ability to scan or have the materials put into an accessible format; however, this is time intensive and can be expensive. The second barrier applies more specifically to cognitive assessments and other personality or projective instruments with visual items (e.g., Rorschach). What these have in common is that the examiner needs visual acuity in order to administer and score these tests. Specifically, an examiner needs visual acuity in order to score the Block Design, Digit-Symbol Coding, and Symbol Search subtests of the Wechsler Scales, or the visuospatial/non-verbal portion of the Stanford Binet. Similarly, vision is required to administer the entire Rorschach. While the visually impaired clinician could potentially administer nonvisual assessment measures, this severely limits their exposure to adequate training opportunities and thereafter clinical practice options for assessment. Since there are no valid, modified assessment instruments, the visually impaired examiner has not had the opportunity to discover and display their knowledge and abilities in the area of assessment administration.

APA states that training programs should provide training for experience and expertise in those aspects of assessment that a student is expected to perform independently, or with minimally invasive assistive technology (e.g., typing rather than writing examinee responses) (APA Committee for Disabilities, 2010). Such experiences should be consistent with the goals of the program and training afforded other students. Many students with visual impairments are capable of acquiring expertise in assessments and tests, and thus should be provided with opportunities to learn. When tests are accompanied by a visual stimulus that requires visual perception or manipulation exceeding the student's psychomotor proficiencies (e.g., showing the examinee a card with the word that the examiner is also providing orally and asking the examinee to define), it may be possible to adapt the materials in ways that also allow independent performance of assessment administration without compromise to validity. Currently, however, there are no published or standardized adaptations to materials for a visually impaired student who desires to administer an intelligence or achievement test in its entirety.

Despite the fact that only declarative knowledge of assessments is required by APA, it is also acknowledged that operational knowledge (planning, administration, scoring, and interpretation) promotes and builds upon declarative knowledge. When inquiring about personal experience of blind clinicians, it was reported by one clinician that although she was provided with declarative knowledge, she found the knowledge difficult to understand and apply since she was not familiar with the assessment instruments themselves (Schnieder, personal correspondence, July 2010). Another blind therapist described a similar experience. Her experience led her to attempt administration

of an intelligence test (WAIS-III) while in her training program. She was successful but very discouraged because she had to adapt the test on her own, and the administration took six hours (compared to the typical 2-3 hours). However, she reported that the experience increased her understanding and knowledge of the assessment in ways she was not able to accomplish through reading alone (Hughley, personal correspondence, July 2010).

These personal experiences could not be further enhanced or supported through empirical articles because at this time there has been no research on whether a modified form of an intelligence test for visually impaired clinicians is feasible. It can be argued that visually impaired clinicians can have an assessment technician perform the administration and scoring of the processes, but it is the learning through hands-on experience that visually-impaired clinicians have not received during their training. The barriers to the hands-on training are the visual components of the test that include reading words, observing and recording manipulation of materials, and accessing the manual and scoring forms. Moreover, use of technicians may be cost-prohibitive and further may limit the clinician's capacity to operate independently. The assumed position is that students with visual impairments should be afforded opportunities to acquire the level of training (i.e., exposure, experience, expertise) provided to other members of the training program (Johnson-Greene, 2007). Realization of this goal is solely contingent upon a sober and realistic appraisal of what each assessment phase demands, instead of appraising and exploring modified formats of the assessment for the visually impaired examiner/trainee.

Intelligence Tests

There are particular challenges presented with intelligence tests for visually impaired examiners, yet intelligence tests are very often an integral and expected core component to an assessment battery. Historically, intelligence tests have been used for a variety of reasons and in a variety of settings (e.g., schools, placement within the Army, and the giftedness of individuals). Today intelligence tests are given in a standardized form, and are used for measuring cognitive potential, quantifying neurological dysfunction, gathering clinical information, making educational and occupational placement decisions, and developing interventions for educational and vocational settings (Kaufman, & Lichtenberger, 1999). Both historically and currently the Wechsler and Stanford-Binet tests have been the leaders in intelligence testing, with both the Wechsler intelligence scales and Stanford-Binet being among the top ten most commonly administered tests given to children and adults (Spruill, 1991). In fact, the WAIS-III (which has now been updated to the WAIS-IV) is *the* most commonly given adult intelligence test (Spruill, 1991).

The WAIS-IV

The WAIS-IV is an intelligence test for adults ages 16 to 90. The WAIS-IV contains fifteen subtests, with ten of them being core subtests and the remaining five being supplemental subtests. These subtests combine statistically to yield four summary indexes: verbal comprehension index (VCI), perceptual reasoning index (PRI), working memory index (WMI), and processing speed index (PSI). These indices are also statistically combined to yield a full scale IQ score (FSIQ), which is purported to provide

an estimate of overall cognitive ability. Two optional indexes may also be calculated and include the general ability index (GAI) and the cognitive proficiency index (CPI) (Sattler &Ryan, 2009). Lastly, the WAIS-IV yields eight process scores designed to evaluate the abilities contributing to the individual's performance on the subtest. The process scores are an aid to understanding and are not to be used to calculate the index scores, the FSIQ, the GAI, or the CPI.

The core subtests of the WAIS-IV are a combination of ten subtests with three of them making up the verbal comprehension index (similarities, vocabulary, and information), three of them making up the perceptual reasoning index (block design, matrix reasoning, and visual puzzles), with two of them making up the working memory index (digit span and arithmetic), and two of them making up the processing speed index (symbol search and coding). In the WAIS-IV there are five supplemental subtests and each of them can replace a core subtest within a designated index. This means the supplemental subtest comprehension can replace one core subtest in the verbal comprehension index. Similarly the supplemental subtests figure weights and picture completion can each replace one core subtest in the perceptual reasoning index. Additionally the supplemental subtest letter-number sequencing can replace one core subtest in the working memory index and the supplemental subtest cancelation can replace one core subtest in the processing speed index. The supplemental subtests are being included because the Administration and Scoring Manual (p. 29) indicates that a supplemental subtest can replace a core subtest if the core subtest in invalidated. One of the several examples of reasons to replace a core with a supplemental subtest is if there is a clinician error. The supplemental subtests can replace one of the core subtests in the

scale that it is in (e.g., comprehension can replace one of the core subtests in the verbal comprehension index) (Sattler & Ryan, 2009). This process may serve as a way of accommodating the WAIS-IV to a visually impaired examiner; in other words, a subtest that does not require vision could replace one that does without compromise to the overall validity of the scores.

The current standardized administration of the WAIS-IV requires the examiner to use a paper and pencil record form. The examiner is also observing the test takers' behaviors, recording their performance on matching tasks that require manipulation of materials, and timing the subtests. However, standardization of the WAIS-IV has shown that the use of a computer in the testing room to record and/or time answers does not distract the individual or affect the validity of the individual's score on the WAIS-IV (Sattler & Ryan, 2009). This suggests that a visually impaired examiner could use a computerized form during testing to both administer and record the test taker's answers. This also suggests that a computerized version of the scoring materials could be used by the visually impaired examiner, which would replace the printed manual. However, there are aspects of each individual subtest that present logistical concerns for a blind examiner that go beyond the reading of instructions and recording of answers on a computer (e.g., via a screen reading or enlarging program designed for the visually impaired). The problems for the visually impaired examiner become apparent as each subtest of the WAIS-IV is described.

WAIS-IV Elements and Modification Options

The perceptual reasoning scale is comprised of three core subtests and two

supplemental subtests. Block design is the first core subtest, and it requires the examinee to manipulate blocks to exactly match a visual representation of a figure while being timed. Block design measures the examinee's visual processing, visualization, and visual-spatial construct ability among other abilities. For a visually impaired examiner, the barriers to administration of this subtest lie in access to the information on the figure card and the ability to check and record the examinee's attempt at replicating the figure. The next core subtest is matrix reasoning, where the task of the examinee is to examine an incomplete matrix and select whichever of the five choices best completes the matrix. Some of the abilities that this subtest assesses include non-verbal fluid reasoning ability, visual processing, induction, and visualization. For the visually impaired examiner, it is important to note that in the standardized administration the examinee does not have to give the letter corresponding to their answer. The examinee can either say the letter or number of their answer choice, or they can point to the picture, or letter/number of the answer they have chosen. However, this is a necessary modification that needs to be made in order for the examinee's answer to be understood by a visually-impaired examiner. The last core subtest for this scale is visual puzzles, which is a task where the examinee looks at a completed puzzle and selects the three of the six choices that when combined, reconstructs the puzzle. Visual puzzles assesses spatial visual-perceptual reasoning, nonverbal reasoning, nonverbal fluid reasoning, and mental transformation. The examinee would again have to verbally indicate their choices, instead of having the option of pointing to indicate which answer they are choosing.

The perceptual reasoning index has two supplemental subtests, the first is figure weights. This subtest requires the examinee to look at a scale with missing weights and

to select whichever of five choices keeps the scale balanced. This task assesses visual-perceptual quantitative reasoning, visual-perceptual-analytic reasoning, nonverbal reasoning, and inductive logic. Again, the visually impaired examiner would need the examinee to verbally announce what choice they have made to insure accurate recording of their answer. Lastly, picture completion is a supplemental subtest for the perceptual reasoning index. The task is for the examinee to look at a picture of something (such as a car) that is missing a component (such as a wheel), and to identify the missing part. This task assesses crystallized knowledge, visual processing, and general information. There are no administration concerns for a visually impaired examiner, beyond insuring that the cards are in order when they are to be presented to the examinee.

The verbal comprehension index consists of three core subtests and one supplemental subtest. The vocabulary subtest requires the examiner to turn the page of the stimulus book, and point to each of the words (to insure the examinee is tracking which item/word they are currently on) within the stimulus book. The other core and supplemental subtests that comprise this index do not require any modifications for the visually impaired examiner. Similarities requires the examiner to articulate how or why two objects are alike (e.g., tea and coffee, pencil and a piece of chalk, or an inch and a mile). Similarities assesses crystallized intelligence, language development, lexical knowledge, and verbal comprehension. Information is also a core subtest, and the task is for the examinee to provide general information about various topics and things (e.g., how many legs do you have?, or what must you do to make water freeze?). It assesses the examinee's crystallized knowledge, general information, verbal comprehension, and range of factual knowledge. The final core subtest for the verbal comprehension scale is

vocabulary. The task for the examinee is to provide the meaning or definition of the word given and shown by the examiner. This task tests the examinee's crystallized knowledge, language development, lexical knowledge, and verbal comprehension. The only supplemental subtest in the verbal comprehension scale is comprehension. This subtest requires the examinee to provide general information about why or how things are usually done (e.g., why do we wear shoes?, or what is the thing to do if you see someone dropping a package?). This subtest assesses the individual's crystallized intelligence, language development, general information, verbal comprehension, and social judgment. There are no modifications needed for the visually impaired examiner to give the subtest and score the results.

The next scale to make up the WAIS-IV is the working memory index. This consists of two core subtests and one supplemental subtest. The examiner gives all of the subtests within the working memory index orally, with the responses dictated by the examinee, and finally recorded by the examiner. This means there are no administration related modifications needed for these subtests for a visually impaired examiner to successfully administer and score them. One of the other core subtests is digit span, which is a task where the examinee repeats a series of numbers read by the examiner. There are a total of twenty-eight items, eight that are digit span forward, eight that are digit span backward, and eight digit span sequencing. For the digit span forward, the examinee repeats the numbers exactly as spoken to them, while in digit span backward they repeat them starting with the last given number to the first given number. Digit span sequencing requires the examinee to arrange a series of unsequenced numbers ranging from two to eight in sequential order. This subtest is assesses working memory, memory

span, role memory, immediate auditory memory, concentration, and numerical ability. The second core subtest is arithmetic, which is a task where the examinee is given verbal word problems and a finite amount of time to verbally answer them. This subtest assesses the examinee's quantitative knowledge, short-term memory, fluid reasoning ability, mathematical achievement, and working memory. The only supplemental subtest for the Working Memory Index is letter-number sequencing. This subtest has the examinee listen to a combination of two to eight letters and numbers, and then repeat the combination back with the numbers in ascending order followed by the letters in alphabetical order. Letter-number sequencing assesses the examinee's working memory, memory span, role memory, immediate auditory memory, attention, and concentration.

Finally, there is the processing speed index of the WAIS-IV, which is comprised of two core subtests and one supplemental subtest. The first core subtest is symbol search, and requires the examinee to decide whether a stimulus figure (a symbol) appears in an array of symbols. They are then to mark "Yes" if the target symbol does appear in the array and "No" if the target symbol does not appear. The subtest assesses processing and perceptual speed, rate of test taking, psychomotor speed, attention, and concentration. The other core subtest in the processing speed index is coding. This subtest requires the examinee to copy symbols assigned to numbers from a key. This subtest measures processing speed, rate of test taking, visual-motor coordination, visual short-term memory, attention, and concentration. The supplemental subtest in the processing speed index is cancellation. This is a task where the examinee scans a structure arrangement of shapes and marks the target shapes in an array. This task assesses for the examinee's processing and perceptual speed, rate of test taking, speed of mental operation, and

scanning ability. For all three subtests there are two aspects of administration and scoring that are problematic for the visually impaired examiner. First, there is the need to check or insure that the examinee understands the task and is performing it correctly during the practice items. Second, the examinee is marking or drawing their answers in the test materials for the three subtests. Thus, the subtests would need to be modified so that the visually impaired examiner could score them.

WAIS-IV Validity

The WAIS-IV was standardized using a total of 2,200 individuals from the United States, ranging from age sixteen to ninety. The exceptions to this are Cancellation, Figure Weights, and Letter-Number Sequencing subtests, which were standardized with 1,800 adults ranging from age sixteen to sixty-nine. There is no stated reason in either the Administration and Scoring Manual or the Technical and Interpretation Manual as to why the number of individuals was different, or why there are no normative data for ages sixty-nine to ninety for these subtests (Sattler & Ryan, 2009). The demographic variables that were used to obtain a stratified sample included age, sex, ethnicity, education level, geographic location, and parent's level of education for individuals age sixteen to nineteen.

The WAIS-IV is considered to have excellent reliability, with high internal consistency reliability coefficients, and high reliability estimates for all of the indices, the Full Scale IQ, and other subtest scaled scores. The internal consistency reliability is lower for the individual subtests due to there being fewer items in any one subtest than there are in indexes that are made up of several subtests (Sattler & Ryan, 2009). The WAIS-IV has

been found to be stable, with high test-retest reliability. Furthermore, there have been studies that have compared the WAIS-IV to the WAIS-III, WISC-IV, and measures of achievement (e.g., WIAT-II), memory, neuropsychological status, and executive functioning that indicate that the WAIS-IV has satisfactory criterion validity. It has also been reported in studies found in the Technical and Interpretive Manual that the WAIS-IV is a good measure of general intelligence, which implies good construct validity (Sattler & Ryan, 2009).

Threats to Validity Created by Modifications

When any test is modified, the validity of the assessment can be threatened by construct under-representation, and task-irrelevant variance (Messick, 1995). Construct under-representation occurs when the assessment process is altered in ways that reduce the intended target of the assessment. Task-irrelevant variance occurs when the assessment process is influenced by factors that are not the intended target of the assessment (Johnson-Greene et al. 2007). An example of task-irrelevant variance would be giving a visually impaired examinee the Comprehension subtest without adaptation. The visually impaired examinee's score would be highly influenced by visual acuity skills (which are not intended targets of the assessment). Based on these factors, then, the implication is that the adaptation of the answer form and scoring materials to a modified format (e.g., electronic or Braille format) would retain the validity of the assessment. However, the process of modifying the WAIS-IV subtests themselves so as to be an accessible assessment for a visually impaired examiner could potentially compromise validity.

Because of the possibility of task-irrelevant variance or reduced construct representation for the examinee, such modifications to test administration must be considered carefully. A study done by a deaf examiner found that the presence of an interpreter was distracting to most children, young children, and cognitively-disabled examinees. She concluded that the presence of the interpreter introduced test-irrelevant variance to the assessment and thus she would not assess these populations (Braden, Kostrubala & Reed, 1995). A similar case could be found with the introduction of adapted WAIS-IV materials, and will be carefully considered during the course of assessment with such adapted materials.

The function of the WIAS-IV is to measure intelligence; however, it is also used in conjunction with other measures to yield additional information about an individual's functioning. The WAIS-IV is used with the Wechsler Individual Achievement Test - II (WIAT-II) to look at the discrepancy between an individual's intellectual functioning and their achievement academically. The WIAT-II comprehensive battery consists of nine subtests which yield four standardized composite scores (e.g., mathematics, reading) (mean = 100) and a total achievement score. The WAIS-IV and WIAT-II have been examined in relation to one another to evaluate the correlation between composite scores and the total achievement score and WAIS-IV Full Scale IQ. The correlations revealed by these between group comparisons provides concurrent validity of the two measures. The relationship between an individual's scores on the two tests is revealed by this correlation. The relationship between the two tests also provides face validity to each assessment by demonstrating that the subtests or indexes are testing what they are aiming to test and is supported through the relationship with a subtest on another test. Since there is an established relationship between the standardized WAIS-IV and WIAT-II it is proposed that a similar relationship can exist for an individual's WAIS-IV scores on the

modified WAIS-IV and their WAIS-IV scores on the standardized version, which would indicate the consistency of an individual's scores through the relationship of their modified WAIS-IV and WIAT-II scores and their standardized WAIS-IV and WIAT-II scores. With the discovery of a similar relationship between the modified WAIS-IV and WIAT-II the modified WAIS-IV, it may be concluded that the modified WAIS-IV is assessing intelligence in a similar way as the standardized WAIS-IV.

Understanding the Necessity of Modifying the WAIS-IV

In conclusion, it has been found that Doctoral Programs in Psychology are required by APA to teach declarative knowledge in regards to assessments, with hands on experience (operational knowledge) frequently used to meet this requirement. Furthermore, the field of psychology has a significant number of individuals with visual impairments both pursing and practicing with a Doctorate in Clinical Psychology. However, there are no clear guidelines, broadly accepted expectations, or modified solutions to provide for training with or clinical use of assessment instruments for these clinicians with visual impairments. Intelligence tests have been universally the most challenging assessments for clinicians who are visually impaired, due primarily to the fact that aspects of the test require visual acuity, and that the test is currently not available in a format other than print. This naturally leads to the question of what modifications can be made to an intelligence test (like the WAIS-IV) that make it accessible for a clinician that is visually impaired, while maintaining the validity, reliability, and intentions of the assessment tool. Development of a valid modified WAIS-IV would not only promote training of psychologists in keeping with professional guidelines, but would allow

practicing psychologists to expand their scope of practice to include the administration of intelligence tests.

Specific Aim

The specific aim of this study is to develop a modified form of the WAIS-IV that can be administered by a visually impaired examiner, and that yields scores that are not significantly different from those obtained by the normative sample of the currently standardized WAIS-IV. This will be done by looking for significant differences between the individual's scores on the modified WAIS-IV and the standardized WAIS-IV. These results will be cross validated by looking at the relationship between the modified WAIS-IV and the WIAT-II.A secondary aim of the study, if significant score differences are found, is to generate a regression equation that results in a method for calculating Index and FSIQ scores that are equivalent to the WAIS-IV standardized assessment scores.

Hypothesis One

The subtest scores for the modified administration of the WAIS-IV will not be significantly different from the subtest scores for the WAIS-IV normative group.

Hypothesis Two

The Index Scores (PCI, PRI, WMI, and PSI) for the modified administration of the WAIS-IV will not be significantly different from the Index Scores for the WAIS-IV normative group.

Hypothesis Three

The Full Scale IQ for the modified administration of the WAIS-IV will not be significantly different from the Full Scale IQ for the WAIS-IV normative group.

Hypothesis Four

The correlations between the Full Scale IQ and index scores of the modified WAIS-IV and the index and total achievement score of the WIAT-II will be of similar strength as as the correlates between the Full Scale IQ and index scores of the standardized WAIS-IV and the index and total achievement score of the WIAT-II.

CHAPTER TWO

METHODS

Participants

The sample consisted of 27 students and professionals with at least 17 years of education, recruited from Loma Linda University Medical Center, Loma Linda University Psychology Doctorate program, and local elementary and high schools. Participants were required to have no previous experience with giving either the WAIS-IV or the WIAT-II. Additionally they were not permitted to participate in the study if they had been administered either the WAIS-IV or WIAT-II. Lastly, participants could not participate in the study if they had significant visual, hearing or mobility impairments that would influence their ability to perform any of the tasks of either assessment.

Participants ranged in age from 21-64 years (mean age = 38.1). Of these participants, nineteen were female and eight were male. Seventeen participants were white/Caucasian, six were Hispanic, two were Asian, and two considered themselves to be biracial. The participants ranged in occupations with sixteen participants working as teachers, six participants are currently students, four participants work in the healthcare field, and one participant is an engineer. See Table 1 for complete demographics of participants. When comparing this sample to the standardizing sample (which is consistent with census data) for gender and ethnicity, there are several differences. The standardizing sample had an equal number of men and women; whereas this study has more female than male participants. Additionally the standardizing sample was 70% Euro American (Caucasian), 13.1% Hispanic, 11.9% African American, 3.3% Asian and 1.8% other (Sattler & Ryan, 2009). The most notable difference is that this study had no

participants that were African American, suggesting that it is not an exact representation of the standardizing sample or the census data.

Table 1

Demographic Descriptive of Participants

Demographic Characteristic	Percentage (Raw #)	Mean (SD)
Gender		
Female	70.4.0% (19)	
Male	29.6% (8)	
Age		38.15 (11.87)
Ethnicity		
White/Caucasian	63.0% (17)	
Hispanic	22.2% (6)	
Asian	7.4% (2)	
Biracial	7.4% (2)	
Occupation		
Teacher	59.3% (16)	
Student	22.2% (6)	
Healthcare Provider	14.8% (4)	
Engineer	3.7% (1)	

The normative group is the sample of individuals used in the standardization of the WAIS-IV. These norms are available in the WAIS-IV Administration and Scoring Manual. The means, standard deviations and sample sizes for each of the subtests, Indices, and the Full Scale IQ serve as the normative data for the standardized version of the WAIS-IV.

Examiners

The modified version of the WAIS-IV was given by a single visually impaired examiner who designed the modified score form, modified materials, and modified scoring materials. The examiner was trained through her graduate training to administer the WAIS-IV using the standardized WAIS-IV. After the examiner made the modifications to the score form, materials, and scoring materials it was administered several times for practice with both the modifications and nuances of administering an assessment where standardization is necessary. The modifications made to the score form, materials, and scoring materials are general enough to be used by other examiners who are visually impaired and have familiarity with usual adaptive equipment such as an adapted stopwatch, however this has not been tested.

The examiners that administered the standardized version of the WAIS-IV and the WIAT-II were recruited through their graduate level assessment course. They were then trained using a three step processes where they observed an advanced examiner, demonstrated their level of understanding and skill to the same examiner, and then practiced administration of the assessment approximately ten times with scheduled and periodic observations by the advanced examiner. This was both examiners first experience with administration of the WAIS-IV as well as their first experience being the examiner in a research project using any neuropsychological assessment.

Measures: The WAIS-IV was used in its entirety, once in standardized fashion and once with modifications to enable a visually impaired examiner to administer the assessment. The WAIS-IV is the most recent addition of the Wechsler Adult Intelligence Test, and is used to measure adult and adolescent intelligence. The WAIS-IV consists of 10 subtests

which are combined statistically to yield four index scores (VCI, PRI, PSI, WMI), a Full Scale IQ score (FSIQ), and a General Ability Index (GAI). The mean of the indices and FSIQ is 100 with a standard deviation of 15. The mean of each subtest is 10 with a standard deviation of three. This assessment also includes five supplemental subtests, which are designed to be used with individuals ages sixteen to ninety years and eleven months old.

The WIAT-II was used in its entirety with no modifications made to the administration or scoring of the measure. The WIAT-II is not the most recent version of the WIAT, however it was the most recent version that was available at the time of study design. The WIAT-II measures academically based achievement in children and adults. The WIAT-II consists of 9 subtests, which are combined statistically to yield four index scores and a total achievement score. The mean of the subtests, indices and the total achievement score is 100 with a standard deviation of 15.

Procedure: Participants completed testing in two sessions, approximately four months apart. In the first session, participants were administered the modified version of the WAIS-IV by one visually impaired examiner (AP). In the second session, each participant completed the standardized WAIS-IV and the standardized WIAT-II. Two research assistants (initials) without visual impairment completed this portion of the testing.

The modified WAIS-IV was given in its entirety, with the changes explained below to the included subtests, the format of the scoring form and some of the testing and scoring materials (see table 2). These changes preserved the ten subtest model of the WAIS-IV, maintained the allotted time limits, and still preserved the intended assessment

of the examinee's functioning. However, all ten core subtests were not used (the core subtest Coding from the Processing Speed Index was not used) due to the complexity of the subtest for modification. The Coding subtest was replaced with the Cancellation subtest, which is a supplemental subtest within the same (Processing Speed) Index. .

Participants were given the same ten subtests as part of the standardized WAIS-IV administration. Due to administration error, however, fourteen of the participants were given only item 1 of the cancellation subtest (the cancellation subtest score is a sum of the item 1 score and item 2 score). After a correlation was run on item 1 and item 2 of the cancellation subtest for those fifteen participants who had been properly administered both items, it was found that item 1 and 2 were highly correlated (r=0.80). Given this high correlation as well as constructional similarities between items 1 and 2 (the target shapes are in the same locations for both items, the same scoring template is used for both items), it was deemed appropriate to replace a missing item 2 score for those fourteen participants with their item 1 score. The participants who were given both item 1 and item 2 had no alterations made to their scores.

Immediately following the administration of the standardized WAIS-IV, participants were given the WIAT-II. Participants were given the WIAT-II in its entirety with no changes or modifications made to the administration or scoring of the test. The four indices were calculated (Reading, Mathematics, Written Language, and Oral Language). Additionally the Total Achievement score for each participant was calculated.

Table 2:

Modifications to Subtests of WAIS-IV

Subtest	Record Form	Testing Materials	Test Administration	Scoring Materials
Block Design (Core, PRI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual. • Does not include a place to record examinee's block design.	• Each block has one tactile bump on each full red, and half red side of the block. The white sections do not have a tactile bump.	• There are no changes to the administration. • The examinee is instructed that the tactile dots are not part of the task, so to ignore them.	• The examiner has an answer booklet that has embossed (tactile) representations of each correct Block Design Item. There are corresponding tactile dots on the red portions that are on the blocks.
Similarities (Core, VCI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• There are no changes made to the materials.	• There are no changes made to the administration.	• There are no changes made to the scoring materials.
Matrix Reasoning (Core, PRI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• There are no changes made to the materials.	• The examinee is instructed to verbally provide their response (the letter or number they are choosing)	• There are no changes made to the scoring materials.
Visual Puzzles (Core, PRI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• There are no changes made to the materials.	• The examinee is instructed to verbally provide their response (the letter or number they are choosing)	• There are no changes made to the scoring materials.

Vocabulary (Core, VCI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• A tiny tactile dot is placed next to each item in the stimulus book.	• There are no changes to the administration. • The examinee is instructed that the tactile dots are not part of the task, so to ignore them.	• There are no changes made to the scoring materials.
Digit Span (Core, WMI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• There are no changes made to the scoring materials.	• There are no changes made to the scoring materials.	• There are no changes made to the scoring materials.
Arithmetic (Core, WMI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• There are no changes made to the scoring materials.	There are no changes made to the scoring materials.	• There are no changes made to the scoring materials.
Symbol Search (Core, PSI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• A spiral bound book is used with a piece of cork on each page. • Each page of the Symbol Search subtest is attached to a page of the spiral bound book	• The examinee is instructed to punch the NO box with their pen, when the target symbol is not present.	• A clear plastic sheet is used with square holes cut out to match the boxes that should have been punched. • Examiner can count total punches - # correct to get number wrong.
Cancellation (Supplimental, PSI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• Each item (treated like single sided instead of double sided) is attached to a full sheet of cork, before being given to examinee.	• The examinee is instructed to punch the target symbol as they scan through each row.	• A similar scoring sheet is used with the boxes cut out, so examiner can feel if object is punched. • Examiner can count total punches - #correct to get number wrong.

Information (Core, VCI)	• Electronic form for computer use. • Includes correct answers and standardized administration instructions from Scoring and Administration Manual.	• There are no changes made to the scoring materials.	There are no changes made to the scoring materials.	• There are no changes made to the scoring materials.

Modified WAIS-IV Administration

The record form is standardized in paper form, where the examiner writes down all the examinee's responses, the time it took them to complete tasks, and provides the examiner with information about discontinuation rules, start points, and time limits for the subtest. The modified version of the record form is electronic in format. This allows the examiner to use a computer with screen reading software (software that reads the text on the computer screen), and wear a single headphone that insures the examiner's ability to read through and administer the subtests without the examinee hearing anything.

The WAIS-IV was given to each examinee with the modifications made to the record form, the testing materials, and the method of responding by the examinee. In addition, the examiner used a computerized stopwatch and single headphone throughout the administration of the WAIS-IV. The modified form of the WAIS-IV was given to each examinee with the same changes made and by the same examiner. There were no other substitutions of subtests (beside the substitution of Cancellation as described above), and no changes to allowed time for subtests or instructions given to the examinee.

Modified WAIS-IV Scoring: The modified version of the WAIS-IV was scored by the visually impaired examiner. Once raw scores were obtained for each of the subtests, the visually impaired examiner used the scoring manual to convert the raw scores to standardized t-scores which were then used in the statistical analyses. The WAIS-IV provides age adjusted scoring, however adjusting for level of education is not part of the normative data used for scoring.

Cross-Validating using the WIAT-II

The WIAT-II was given to each participant and then scored to yield standardized t-scores for the indices and full scale achievement score. The relationship between the WIAT-II and both the standardized and modified WAIS-IV was calculated using correlations. The strength of the relationship between the modified WAIS-IV and the WIAT-II was compared to the strength of the relationship between the standardized WAIS-IV and the WIAT-II by examining the value of the correlation using the following generally agreed upon criterion. A correlation that ranges between -1.0/+1.0 to -0.5/+0.5 is a strong relationship, -0.5/+0.5 to -0.3/+0.3 is a medium relation, -0.3/+0.3 to -0.1/+0.1 is a weak relationship, and -0.1 to +0.1 is no relationship or a very weak relationship.

Statistical Analyses: To test for significant differences between the modified WAIS-IV and standardized WAIS-IV at the subtest, index, and full scale level, paired t-test were used. To examine the relationship between the standardized WAIS-IV and the WIAT-II, correlational analyses were conducted. Similarly, to examine the relationship between the modified WAIS-IV and the WAIT-II, correlations were conducted. The strength of the relationship was then classified as strong, medium, weak, or no relationship. The strength of the relationship between the standardized WAIS-IV and the WIAT-II was then compared to the strength of the relationship between the modified WAIS-IV and the WIAT-II, looking for similarities and differences in the classified strengths of relationship between the subtests. Additionally, the significance of the correlations were also used to look for similarities in the way the standardized WAIS-IV related to the WIAT-II as compared to how the modified WAIS-IV related to the WIAT-II.

CHAPTER THREE

RESULTS

At the subtest level it was found that there are both significant and non significant differences between scores on the modified WAIS-IV and standardized WAIS-IV. On average, participants scored significantly higher on standardized block design (M = 12.19, SE = 0.52), than on modified block design (M = 10.96, SE = 0.50, $t(26) = -2.62$, $p < .05$, $r = .46$), standardized vocabulary (M = 13.56, SE = 0.51), than on modified vocabulary (M = 12.26, SE = 0.45, $t(26) = -3.67$, $p < .01$, $r = .58$), standardized symbol search (M = 12.63, SE = 0.48), than on modified symbol search (M = 10.93, SE = 0.46, $t(26) = 3.66$, $p < .01$, $r = .58$), and on standardized information (M = 13.52, SE = 0.42), than on modified information (M = 12.52, SE = 0.40, $t(26) = 3.91$, $p < .01$, $r = .61$). Participants did not score significantly different on the modified and standardized similarities, digit span, matrix reasoning, arithmetic, visual puzzles, or the cancellation subtest (see table 3 for results).

At the index level it was found that there are both significant and non significant differences between scores on indices of the modified WAIS-IV and scores on indices of the standardized WAIS-IV. On average, participants scored significantly higher on the standardized verbal comprehension index (M = 118.26, SE = 2.79), than on the modified verbal comprehension index (M = 111.33, SE = 2.24, $t(26) = -3.47$, $p < .01$, $r = .56$), and on the standardized processing speed index (M = 110.63, SE = 2.07), than on the modified processing speed index (M = 104.78, SE = 1.80, $t(26) = -3.31$, $p < .01$, $r = .54$). Participants did not score significantly different on the perceptual reasoning index or the

working memory index of the standardized and modified WAIS-IV (see table 4 for results).

Table 3

Paired sample t-tests for subtests of modified WAIS-IV and standardized WAIS-IV

Subtest	Mean	Standard Error	*t*	*p* value	*r*
Block Design			-2.62	.01	.46
Standardized	12.19	0.50			
Modified	10.96	0.53			
Similarities			1.97	.06	.36
Standardized	12.37	0.41			
Modified	11.63	0.55			
Digit Span			-1.58	.13	.29
Standardized	11.19	0.53			
Modified	10.59	0.49			
Matrix Reasoning			-0.32	.75	.06
Standardized	11.67	0.65			
Modified	11.89	0.56			
Vocabulary			-3.66	.01	.58
Standardized	13.56	0.51			
Modified	12.26	0.45			
Arithmetic			-1.23	.23	.23
Standardized	12.37	0.48			
Modified	11.81	0.62			
Symbol Search			3.66	.01	.58
Standardized	12.63	0.46			
Modified	10.93	0.47			
Visual Puzzles			-1.45	.16	.27
Standardized	13.19	0.58			
Modified	12.37	0.47			
Information			3.91	.01	.61
Standardized	13.52	0.42			
Modified	12.52	0.40			
Cancellation			-0.78	.44	.16
Standardized	11.29	0.44			
Modified	10.88	0.45			

Table 4

Paired sample t-tests for indices and full scale IQ of modified and standardized WAIS-IV

Subtest	Mean	Standard Error	*t*	*p* value	*r*
Verbal Comprehension Index			-3.48	.01	.56
Standardized	118.26	2.79			
Modified	111.33	2.24			
Perceptual Reasoning Index			-1.54	.13	.29
Standardized	113.33	2.58			
Modified	109.74	2.03			
Working Memory Index			-1.75	.09	.32
Standardized	109.74	2.77			
Modified	106.52	2.34			
Processing Speed Index			-3.31	.01	.54
Standardized	110.63	2.07			
Modified	104.78	1.80			
Full Scale IQ			-5.03	.01	.70
Standardized	116.59	2.18			
Modified	110.59	1.85			

When analyzing differences between the full scale IQ of the modified WAIS-IV and the full scale IQ of the standardized WAIS-IV there was a significant difference between participants' scores (see table 4 for results). On average, participants scored significantly higher on the full scale IQ of the standardized WAIS-IV (M = 116.59, SE = 2.18), than on the full scale IQ of the modified WAIS-IV (M = 110.59, SE = 2.18, $t(26)$ = -5.03, $p < .01$, r = .70).

Standardized WAIS-IV and WIAT-II

The standardized WAIS-IV correlated highly with the WIAT-II across several indices and the full scale IQ. The verbal comprehension index was strongly correlated

with the oral language composite r(27) = .65, p < .01, and moderately correlated with the total achievement score r(27) = .41, p < .05. The perceptual reasoning index was moderately correlated with the written language composite r(27) =.45, p < .05, and strongly correlated with boththe oral language composite r(27) = .55, p < .01, and the total achievement composite score r(27) = .58, p < .01. The working memory index was moderately correlated with the reading composite r(27) = .49, p < .05 and the mathematics composite r(27) = .56, p < .01, and strongly correlated with the written language composite r(27) = .71, p < .01, and the total achievement composite score r(27) = .61, p < .01. The processing speed index was moderately correlated with the mathematics composite r(27) = .41, p < .05. The full scale IQ was moderately correlated with the reading composite r(27) = .44, p < .05, and strongly correlated with the mathematics composite r(27) = .51, p < .01, the written language composite r(27) = .59, p < .01, the oral language composite r(27) = .60, p < .01, and the total achievement composite score r(27) = .73, p < .01 (see table 5).

Modified WAIS-IV and WIAT-II

The modified WAIS-IV correlated with the WIAT-II across several indices and the full scale IQ. The verbal comprehension index was moderately correlated with the written language composite r(27) = .43, p < .05, and was strongly correlated with the oral language composite r(26) = .69, p < .01, and the total achievement score r(26) = .63, p < .01. The perceptual reasoning index was moderately correlated with the oral language composite r(27) =.46, p < .05. The working memory index had a strong correlation with the mathematics composite r(27) = .65, p < .01, the oral language composite r(27) = .749,

$p < .01$, and the total achievement composite score $r(27) = .63$, $p < .01$. The working memory index was moderately correlated with the written language composite $r(27) = .39$, $p < .05$. The processing speed index was moderately correlated with the written language composite $r(27) = .43$, $p < .05$. The full scale IQ was moderately correlated with the mathematics composite $r(27) = .46$, $p < .05$, the written language composite $r(27) = .47$, $p < .05$, and strongly correlated with the oral language composite $r(27) = .66$, $p < .01$, and the total achievement composite score $r(26) = .70$, $p < .01$ (see table 6).

Table 5

Correlations of standardized WAIS-IV and WIAT-II composite scores

Index	Reading	Mathematics	Written Language	Oral Language	Total
VCI	0.25	-0.05	0.35	0.65**	0.41
PRI	0.25	0.33	0.45*	0.55**	0.58**
WMI	0.43*	0.56**	0.71**	0.33	0.61**
PSI	0.29	0.41*	0.21	-0.02	0.33
FSIQ	0.44*	0.51**	0.59**	0.60**	0.73**

*Note: *p < .05, **p < .01*

Table 6

Correlations of modified WAIS-IV and WIAT-II scores

Index	Reading	Mathematics	Written Language	Oral Language	Total
Mod. VCI	0.29	0.31	0.43*	0.69**	0.63**
Mod. PRI	0.17	0.15	0.13	0.46*	0.35
Mod. WMI	0.31	0.65**	0.40*	0.49**	0.63**
Mod. PSI	0.32	0.21	0.43*	-0.33	0.35
Mod. FSIQ	0.36	0.46*	0.47*	0.66**	0.70**

*Note: *p < .05, **p < .01*

Table 7

Strength of correlations of standardized WAIS-IV and WIAT-II composite scores

Index	Reading	Mathematics	Written Language	Oral Language	Total
VCI	Weak	Strong	Moderate	Strong	Moderate
PRI	Weak	Moderate	Moderate	Strong	Strong
WMI	Moderate	Strong	Strong	Moderate	Strong
PSI	Weak	Moderate	Weak	None	Moderate
FSIQ	Moderate	Strong	Strong	Strong	Strong

Table 8

Strength of correlations of modified WAIS-IV and WIAT-II scores

Index	Reading	Mathematics	Written Language	Oral Language	Total
Mod. VCI	Weak	Moderate	Moderate	Strong	Strong
Mod. PRI	Weak	Weak	Weak	Moderate	Moderate
Mod. WMI	Moderate	Strong	Moderate	Moderate	Strong
Mod. PSI	Moderate	Weak	Moderate	Moderate	Moderate
Mod. FSIQ	Moderate	Moderate	Moderate	Strong	Strong

CHAPTER FOUR

DISCUSSION

The hypotheses of this study were that the modified WAIS-IV would not be significantly different from the standardized WAIS-IV at the subtest, index, and full scale IQ level. The hypotheses were not supported in their entirety which initially suggests that the modified WAIS-IV and standardized WAIS-IV are significantly different, and thus that the modified WAIS-IV is not a valid measure. Additionally, it was hypothesized that the modified WAIS-IV would correlate to the WIAT-II similarly to how the standardized WAIS-IV correlates to the WIAT-II. This hypothesis was supported indicating that it was successfully cross-validated, and thus that the modified WAIS-IV has a similar relationship with the WIAT-II that the standardized WAIS-IV has.

Subtests

For both the modified and standardized WAIS-IV the same ten subtests were given to make up a complete intellectual assessment as outlined in the WAIS-IV scoring and technical manual. Out of the ten subtests, participants scored significantly higher on four of the standardized subtests (which they were administered after the modified version) than they did on the modified subtests (taken four months prior). These four subtests were block design, vocabulary, symbol search, and information.

Both block design and symbol search had marked changes in the way they were presented for the modified WAIS-IV. These changes could have impacted the participant's ability to excel in the subtest to the same extent as they were able to on the standardized subtests. However, the average difference in scores on block design between

administrations was 1.23 standardized points, which although higher than anticipated is still not significantly different. While scores on symbol search were significantly different (an average of 1.7 points) for participants for the modified version, it may be speculated that this was because participants were instructed to poke holes instead of drawing circles around their correct answer (as instructed in the standardized version). The difference in motor function could account for the average differences between scores. The increase in score on the standardized version of these two subtests could also reflect practice effects, as the standardized WAIS-IV was administered after the modified version. Although the gain in scores is significant, the analysis does not take in account that during the second (standardized WAIS-IV) administration participants were hearing the instructions, seeing the materials and performing the tasks a second time.

The other two subtests from the standardized version that participants scored significantly higher on were vocabulary (1.3 points higher on average) and information (1.0 point higher on average). The difference in scores for vocabulary could be a result of having three different examiners do the scoring. The fact that there is some room for variability in interpreting an examinee's answer, which could then potentially result in variability in scoring the items, could account for the difference in scores. Additionally, examiners scored only the participants they tested and there was not cross checking of scores. This same argument does not necessary apply to the information subtest, since there is less subjectivity in the scoring. However, the variability in the information subtest could be attributed to the simple fact that the questions were more familiar to the examinee and undoubtedly they remembered the question from the previous administration of the subtest. Moreover, the sample had at least 19 years of education,

which could have facilitated research or “looking up” of answers for the information subtest or definitions of the vocabulary words. The vocabulary and information subtests are particularly vulnerable (when compared to the other subtest) to having answers looked up by the examinee due to the objective quality of the subtest (there are very few if not only one answer/definition to each question), while other subtest are testing domains of intelligence that are less objective and the answers or strategies to the subtests cannot be easily looked up. Furthermore, it is important to consider that individuals who have extensive education may be more primed to follow through on looking up answers to a question that they did not know. It could be speculated that this is due to the years of taking classes, where not knowing a definition or answer to something could mean doing poorly in class or on a test. Additionally it could be speculated that individuals who are highly educated are using their meta-memory as a tool to succeed and continue to use it in a research/testing atmosphere. An example of this was during the modified WAIS-IV testing it was noted that participant thirteen commented after completing the vocabulary and information subtests, “I know I knew more of those, I will have to look them up, because now I am curious.” This participant had a five raw point increase (see Appendix C) from the modified vocabulary score to the standardized vocabulary score (modified = 12, standardized =17). Similarly, the participant had an increase of three points from the modified information score to the standardized information score (modified = 14, standardized = 17). Although there is an increase in scores anticipated as a result of practice effects (test-retest), the difference in scores is greater than in the published data about the normative group (which is an educationally diverse sample) and is contributing to the significant difference between the subtests.

Indices

Participants scored significantly higher on the standardized verbal comprehension index and the processing speed index than on the modified verbal comprehension and processing speed indices. The significant difference seen between scores of the verbal comprehension index is understood easily by examining the subtests that comprise this index: vocabulary, similarities, and information. Vocabulary and information were significantly different, and similarities neared significance ($p = .06$). Scoring of all three subtests arguably involves some degree of subjective judgment. Moreover, the fact that such subtests with less definitive subjectivity in scoring criteria were scored only by the examiners who administered them and not checked by others could have further contributed to this score discrepancy.

Likewise, factors that contributed to the significant difference in processing speed index scores on the standardized and modified versions may be revealed by examining the subtests that comprise the processing speed index (cancellation and symbol search). When the standardized administration of cancellation was done, half of the participants were given the standardized administration of cancellation (item one and item two). As a result, for these participants the item one score was doubled to produce a total raw score, which was then converted to a standardized score. This could have resulted in less variation in the cancellation score than would have been true if the subtest had been given in its entirety. Indeed, the difference between the standardized and modified administration of the cancellation subtest was not significantly different. In contrast, the difference between the standardized and modified administration of the symbol search subtest is significantly different, thus pointing to the symbol search subtest as the source

of the significant difference in processing speed index scores. The differences seen could be because of the modified subtest materials, which were hand made by binding several pages of cork together. Each page of the symbol search test booklet was then separated and secured to the cork page by clips. The pages did not turn with ease and despite efforts to secure the pages there were still pages that moved while the examinee was taking the subtest (which was timed). In addition to the functionality of the modified materials there was also a notable difference in the task asked of participants in the modified version, since they were asked to poke a whole instead of circling the correction answer. Although they were given the opportunity to practice the task with the sample items the examiner was not able to check for correctness or mastery of the task. This suggests that further exploration into methods that would minimize the impact of the modifications to this test would be advantageous. This could be looked at through re-administration of the subtests with a randomized design, with half of the participants being given the modified subtest first while the other half was given the standardized subtest first. This would allow separation of practice effects and impact of the modified materials.

Full Scale IQ

The significantly higher full scale IQ score for the standardized WAIS-IV than the modified WAIS-IV appears to be explained by the significant difference between the scores on the indices and the subtests as described above. Overall, however, the average increase in scores for this study sample was comparable to that of the WAIS-IV standardization sample. The normative sample of individuals who took the WAIS-IV twice, with a four to sixteen week timespan between test administrations had on average

a 4.5 to 5 standardized point increase in their full scale IQ score (Sattler & Ryan, 2009). Since the time between testing was four months (which was the suggested length of time between administrations), there is enough similarity that would suggest a similar increase in score as seen in the normative sample. When looking at the scores for the normative sample from the first to the second testing point there was an average increase in score for the full scale IQ of 4.3 points. Subsequently there was an increase of 2.5 points for the VCI, 3.9 points for the PRI, 3.1 points for the WMI, and 4.4 points for the PSI. The normative sample did not provide specific norms for a higher educated sample, which means there is no definitive answer on whether or not individuals with more education perform differently than those with less education on a test retest model. However, given the skills of studying, performing well on "tests" and knowledge and comfort with accessing knowledge, combined with the informed consent that indicated participants would be taking the test twice, participants had the opportunity and means to study or look up information after the first administration of the WAIS-IV. This is further demonstrated by the average increase of scores from administration one (modified WAIS-IV) to administration two (standardized WAIS-IV).

WAIS-IV and WIAT-II

The relationship seen between the modified WAIS-IV and the WIAT-II is similar in several ways to the relationship between the standardized WAIS-IV and the WIAT-II (seen in table 5, table 6, table 7 and table 8). When looking at comparing the overall score by looking at the FSIQ and the total composite score there is a similarly strong relationship between the modified WAIS-IV full scale IQ and the WIAT-II total

composite score, and the standardized WAIS-IV full scale IQ and the WIAT-II total composite score. This suggests that the modified WAIS-IV has a similar strength of relationship with the WIAT-II as the standardized WAIS-IV when looking at the individuals' overall achievement score and intelligence score, meaning that the modifications made to the WAIS-IV are not impacting the relationship to the WIAT-II despite the difference found between the modified WAIS-IV and standardized WAIS-IV.

Influencing Factors

The particular sample used for the study was homogeneous in the number of years of education. This sample was used in part as a convenience sample and in part as an attempt to minimize the variance to the full scale IQ scores. However, the highly educated sample was not represented in the scoring and statistical manual for the WAIS-IV, meaning there was no comparative test-retest data available by which to evaluate how the current sample's practice effects compared to those of a similarly educated normative sample. Additionally, the sample had an overrepresentation of women as compared to the normative sample for the WAIS-IV.

The diversity of examiners used for the study could have impacted the consistency of administration of the WAIS-IV as well as the scoring. The modified WAIS-IV was given by only one examiner (who is visually impaired), while the standardized version was given by two separate examiners. The examiner who administered the modified version had more exposure to the WAIS-IV structure for both the administration and scoring, while the two examiners who administered the standardized version were trained using the WAIS-IV in the classroom setting and

received additional training on the measure in preparation for their role in this study, it is possible that variability in exposure and experience could have contributed to some of the administration errors that occurred or reduced some reliability in scoring the more subjective elements of the tests.

An additional influencing factor on the results of the study is the duration of time between the first administration and the second administration. The time between administrations in the normative sample data for the WAIS-IV varied from four weeks to four months. In the current study, the modified WAIS-IV was consistently administered four months prior to the standardized WAIS-IV. Thus, the current test-retest/practice effects may not be readily compared to those observed in the standardization sample.

A final influencing factor to be considered when interpreting the results is that the administration of the modified and standardized versions of the WAIS-IV was not randomized. Results of the current study revealed a consistent pattern of significantly higher scores on the standardized version compared to the modified version. While it may be presumed that the higher scores may reflect practice effects, this cannot be examined due to this lack of randomization.

Limitations

Since the study was conducted as a preliminary evaluation of a modified version of the WAIS-IV there were aspects of the assessment that were new and innovative. These included using a computer to score the exam, having the block design scoring manual in Braille, as well as using alternative materials and methods of answering for symbol search and cancellation. Specifically, it is important to consider that the

modifications to the materials were handmade, meaning they lacked some sophistication and refinement that the standardized (factory created) materials possess. Which could of impacted performance due to not being refined and taking longer to manipulate (turning the pages for symbol search for example). Furthermore, some of the modifications were visible to the participants which adds distraction and curiosity for the participants as to what is the purpose of the modification (plastic dots on the red sections of the blocks for block design is a good example of this). Additionally, the study had twenty-seven participants, which had sufficient power (P = 0.80), but is a small sample size compared to the 2,000 participants tested and re-tested in the normative sample of the WAIS-IV. Additionally, within the scoring and statistical manual of the WAIS-IV there is no reference to statistical analyses done on the test retest data that would definitively state whether the standardized WAIS-IV had significant differences at the subtest, index and full scale level when given to the same participants a second time. Another potentially influential factor was the use of multiple examiners/scorers of the standardized WAIS-IV for this study. The fact that there were three individuals scoring the assessment could have added unexpected variability to the scores of the modified and standardized WAIS-IV.

The sample population of the study could also be a limitation, since all participants had at least nineteen years of education. Additionally, when looking at the distribution of occupations of participants, it can be noted that all participants are in highly competitive and learning-based occupations. With participants in the health care, teaching, and engineering fields as well as several students it can be hypothesized that these individuals are seekers of knowledge. The fact that participants had some

opportunity to learn the exam (during the first administration) could have influenced their scores on the second administration of the assessment. Additionally, the lack of randomizing the administration of the modified and standardized WAIS-IV contributed to speculation about what differences between the two administrations are due to retest effects and the modifications made to the WAIS-IV (which was administered to all participants first).

Recommendations

The modified WAIS-IV created as part of this study is the first attempt at accessibility of assessments for the visually impaired psychologist. Although there appears to be some impact of the modifications on the overall results it does not appear to be the modifications alone that impacted the similarity of participants standardized and modified WAIS-IV scores with the WIAT-II. The modified measure should be further examined and tested with a less homogenous population to determine what potential variable (modified materials, multiple examiners, or high educational level of population) had the greatest impact on the results. Ultimately, with others' input on the modifications and experience administering the test, the potential impact the modifications are having could be further understood and changed.

It is important to note that the modified version of the WAIS-IV was used successfully for a visually impaired examiner to administer the entire exam. This is the first attempt to make an assessment measure accessible for both the learning of a graduate student and for a professional psychologist with a visual impairment. It is important to note that the assessment has only been given by one visually impaired examiner, who

designed the modifications using her personal strengths. This could potentially limit the generalizability of the modifications to other examiners with visual impairments since it is difficult to determine the ease with which other examiners with visual impairments can use tools such as a computer (which is imperative for the modified score form) or other tactile materials. The results indicate that this modified assessment could be used as a teaching tool at the minimum. The modified WAIS-IV would allow graduate students who are learning assessment to gain a hands on approach to learning that their peers are currently receiving. Moreover, the test was successfully given 27 times, and scores on the modified administration more often than not fell within the same classifying category (e.g., average, above average) as when administered in standardized form. This speaks to its potential as a functional assessment tool for the visually impaired psychologist.

REFERENCES

American Psychological Association Education Directorate (2007). Guidelines and Principles for Accreditation of Programs in Professional Psychology. Washington DC: APA Press.

Axelrod, B., & Paolo, A. (1998). Utility of WAIS-R seven-subtest short form as applied to the standardization sample. *Psychological Assessment, 10*(1), 33-37.

Braden, J., Kostrubala, C., Reed, J. (1994). Why do deaf children score differentially on performance vs. motor-reduced nonverbal intelligence tests? Journal of Psychoeducational Assessment 12(4), 357-363.

Hughey, S. (2010). Personal Communication.

Johnson-Greene, D., Braden, J., Dial, J., Fitzpatrick, P., Leung, P., Schneider, K., et al. (2008 - Unpublished). Handbook on Training in psychological testing for graduate students with disabilities. APA Press: Washington DC.

Khubchandani, A. (2010). Resource Guide for Psychology Graduate Students with Disabilities: Introduction to the Relevant Laws and Keyterms of the Americans with Disabilites Act. Retrieved July 15, 2010, from http://www.apa.org/pi/disability/resources/publications/resource-guide.aspx

Lange, R., Iverson, G., Viljoen, H., & Brink, J. (2007). Clinical Validation of Canadian WAIS-III Index Short Forms in Inpatient Neuropsychiatry and Forensic Psychiatry. *The clinical neuropsychologist, 21*(3), 434-441.

Mayerson, A. (1993). The history of the ADA: A movement perspective. *Implementing the Americans with Disabilities Act: Rights and responsibilities of all Americans* Retrieved 2010, July 15, from http://law.marquette.edu/s3/site/docs/psconference/history-of-ada.pdf

Sattler, J., & Ryan, J. (2009). Assessment with the WAIS-IV: La Mesa, CA: Jerome M. Sattler, Publisher.

Schneider, K. (2010). Personal Communication.

Schoenberg, M., Duff, K., Dorfman, K., & Adams, R. (2004). Differential Estimation of Verbal Intelligence and Performance Intelligence Scores from Combined Performance and Demographic Variables: The OPIE-3 Verbal and Performance Algorithms. *The clinical neuropsychologist, 18*(2), 266-276.

Spruill, J. (1991). A comparison of the Wechsler adult intelligence scale–revised with the Stanford-Binet intelligence scale for mentally retarded adults. *Psychological Assessment: A Journal of Consulting and Clinical Psychology, 3*(1), 1–3.

APPENDIX A

INFORMED CONSENT FORM

Loma Linda University Department of Psychology

Modified Administration of an Intelligence Test for Visually Impaired Examiners: A Preliminary Validity Study

Investigators:

Susan Ropacki, Ph.D.
Amy Pitchforth, M.A.

You have been invited to take part in a research project described below. The researcher will explain the project to you in detail. The researcher will also explain the possible risks and possible benefits of being in the study. Please read the form and ask any questions you may have. Then, if you decide to participate in the study, please sign and date this form in front of the person who explained the study to you. You will be given a copy of this form to keep.

Purpose and Procedures:
Intelligence tests are among the most common tests administered by clinical psychologists. One limitation of intelligence tests, however, is that they require that both the examiner and the examinee have adequate vision and hearing. Therefore, students or professionals who are visually impaired are not able to administer such tests, even though being able to do so is important for training and practice in mental health professions such as psychology. This study aims to develop a modified, valid version of one of the most commonly administered intelligence tests that may be administered by visually impaired students and clinicians. Results of this study may help broaden training opportunities for visually impaired students and practice options for visually impaired clinicians.

If you decide to participate in this study, your participation may last a total of approximately six hours. Testing will be completed in two testing sessions, with testing session one lasting approximately four hours and testing session two lasting approximately two hours. The second testing session will take place approximately 4-6 months after the first testing session. If you choose to participate in this study, you will be asked to take the standard version of a common intelligence test, the modified version of the intelligence test being investigated in this study, and a test of academic skills/achievement. The intelligence test (in both forms) is a paper-and-pencil test of skills such as attention span, reasoning, vocabulary, and factual knowledge. The achievement test is a paper-and-pencil test of skills typically learned in school such as mathematics and reading.

If you decide to participate in this study, here is what will happen:

- You will be given the modified intelligence test by a visually impaired examiner.
- You will be given the standard intelligence test by a sighted examiner.
- You will be given an academic achievement test by a sighted examiner.
- You will be asked to provide your age and how many years of education you have.

Risks or discomforts:
A potential discomfort of this study is that you may become fatigued by the testing process. You will, however, be given opportunity for breaks. While it is preferred that you complete testing in a minimum of two hour blocks, you may also choose to have your testing completed over shorter testing periods, if needed. A potential risk for students participating in this study is that others could have knowledge of your intellectual and achievement scores, as psychology students may be examiners for this study. However, all effort will be made to preserve your confidentiality. See the section below for more detailed information on how your confidentiality will be protected throughout the study. Consent forms and all data will be maintained separately, each within locked file cabinets in the Neuropsychological Assessment and Research Laboratory. All electronic data will likewise be protected using passwords and encryption, and only study identification numbers will be contained in the database.

Benefits:
Participation in this study may provide you with the educational opportunity to experience test administration from an examinee's/client's perspective. Also, your participation will benefit the field of psychology by helping us to understand how to improve the accessibility of assessment and other areas of clinical practice for the visually impaired.

Participant's Rights:
Participation in this study is voluntary. Your decision whether or not to participate will not affect your present or future academic performance or grades. You have the right to refuse to participate in this study. You have the right to withdraw from this study at any time without affect on your present or future grades.

Confidentiality:
All of your personal information will be held confidential and available only to those directly involved in the study or assessment procedures. You will be given an identification number upon entry into the study which will be used to identify your test results. Consent forms and all data will be maintained separately, each within locked file cabinets in the Neuropsychological Assessment and Research Laboratory. All electronic data will likewise be protected using passwords and encryption, and only study identification numbers will be contained in the database. Threats to confidentiality will further be controlled by limiting the number of trained research assistants conducting the

cognitive testing. Moreover, all data will be scored by a research assistant not directly involved in the testing of participants. Those scoring and recording data will have access only to participant identification numbers.

Reimbursement:
There is no financial reimbursement offered for this study. Those that choose to participate in this study and who are also enrolled in PSYC 512 will receive course credit as outlined by the course instructor (Dr. Ropacki). If you choose not to participate in this study or withdraw from this study for any reason, you may still receive course credit for participating in the assessment procedures. You will also be provided with alternative opportunities to receive course credit for PSYC 512.

Impartial Third Party Contact:
If you wish to contact an impartial third party not associated with this study regarding any question or complaint you may have about the study, you may contact the Office of Patient Relations, Loma Linda University Medical Center, Loma Linda, CA 92354, phone (909) 558-4647 for information and assistance.

Informed Consent statement
a. I have read the contents of the consent form and have listened to the verbal explanation given by the investigator. My questions concerning this study have been answered to my satisfaction. I herby give voluntary consent to participate in this study. Signing this consent document does not waive my rights, nor does it release the investigator, institution or sponsors from their responsibility. I may call Dr. Susan Ropacki during routine office hours at (909) 558- 8615 if I have additional questions or concerns.

b. I have been given a copy of this consent form_____.

_____ _____

Signature of Subject Date

I have reviewed the contents of t this consent form with the person signing above. The potential risks and benefits of the study have been explained to me.

_____ _____

Signature of Investigator Date

APPENDIX B

Participant's Standard scores on indices and full scale IQ for the modified (Mod.) WAIS-IV and standard (Std.) WAIS-IV.

Subject	VCI		PRI		WMI		PSI		FSIQ	
	Mod.	Std.	Mod.	Std.	Mod.	Std.	Mod.	Std.	Mod.	Std.
1	98	100	98	102	97	97	97	105	97	101
2	108	110	129	105	111	97	111	114	119	123
3	108	114	113	115	102	97	105	102	110	110
4	100	141	109	113	86	95	102	102	100	108
5	118	127	107	123	111	122	100	120	112	130
6	85	107	117	117	111	108	108	122	105	116
7	98	103	104	102	80	92	105	100	97	100
8	107	103	102	92	105	108	108	97	105	100
9	107	89	98	105	108	105	122	129	109	112
10	122	132	96	119	105	102	102	120	108	124
11	98	105	100	109	95	102	89	92	95	104
12	114	118	107	119	114	122	120	120	116	115
13	116	134	107	127	102	108	100	102	109	125
14	105	116	109	113	108	128	94	105	106	119
15	108	120	92	88	86	92	97	102	96	102
16	120	132	107	117	133	119	108	120	121	128
17	112	125	115	109	105	95	92	100	109	110
18	125	141	131	131	117	142	114	105	129	139
19	120	122	115	125	117	105	89	105	117	120
20	110	114	123	133	97	102	111	117	114	122
21	120	125	123	123	105	105	97	102	116	119
22	112	110	105	81	92	92	114	113	108	110
23	138	141	123	127	122	131	117	105	133	134
24	105	105	100	123	114	119	105	120	106	112
25	98	102	107	96	114	125	117	137	109	115
26	136	141	123	121	111	117	97	114	123	130
27	114	116	107	125	125	136	111	117	117	130

APPENDIX C

Participant's standard scores on the subtests of the modified (Mod.) WAIS-IV and standard (Std.) WAIS-IV.

Subject	Block Design		Similarities		Digit Span		Matrix Reasoning		Vocabulary	
	Mod.	Std.	Mod.	Std.	Mod.	Std.	Mod.	Std.	Mod.	Std.
1	8	9	11	10	8	8	9	12	9	11
2	18	14	12	14	10	8	11	12	11	10
3	13	16	10	13	9	9	11	9	13	13
4	10	6	10	11	8	11	15	14	10	13
5	11	13	16	15	12	11	12	16	11	15
6	12	14	5	11	13	13	14	12	8	11
7	12	11	10	10	7	8	9	9	10	11
8	7	10	10	10	12	11	14	8	12	10
9	8	12	9	10	10	9	13	13	13	13
10	8	8	15	15	10	9	11	13	13	17
11	11	10	7	9	8	10	10	11	10	11
12	12	16	12	13	10	13	7	8	12	13
13	14	14	13	13	7	9	5	13	12	17
14	10	11	11	13	10	16	10	13	10	12
15	8	10	7	12	8	8	8	4	14	15
16	11	14	13	15	15	12	14	10	13	15
17	12	10	12	14	9	8	13	11	13	14
18	15	16	15	15	13	16	17	15	15	19
19	11	13	16	14	12	10	14	16	16	14
20	13	15	14	15	8	10	15	15	11	11
21	10	11	13	11	9	11	16	16	14	16
22	10	12	11	9	10	11	12	8	12	13
23	14	13	16	15	11	12	15	17	18	17
24	6	13	9	10	13	14	9	12	12	11
25	8	9	10	10	15	16	14	4	9	11
26	14	15	13	14	13	12	13	11	17	19
27	10	14	13	13	16	17	10	13	12	14

APPENDIX D

Participant's scores of subtests on the modified (Mod.) WAIS-IV and standard (Std.) WAIS-IV continued.

Subject	Arithmetic		Symbol Search		Visual Puzzles		Information		Cancellation	
	Mod.	Std.	Mod.	Std.	Mod.	Std.	Mod.	Std.	Mod.	Std.
1	11	11	12	13	12	10	9	9	7	8
2	14	11	15	14	16	7	12	12	9	11
3	12	10	9	11	13	13	12	12	13	10
4	7	7	12	10	10	17	10	13	9	11
5	12	17	11	13	11	13	13	14	9	14
6	11	10	9	14	13	13	9	12	14	14
7	6	9	12	10	11	11	9	11	10	10
8	10	12	12	11	10	8	12	12	9	8
9	13	13	12	18	8	8	12	12	16	11
10	12	12	11	12	9	9	14	14	10	15
11	10	11	8	7	9	14	12	13	8	10
12	15	15	16	15	15	16	14	14	11	12
13	14	14	11	11	15	17	14	17	9	12
14	13	14	10	10	15	13	12	14	8	12
15	7	9	9	11	10	10	14	14	10	11
16	17	15	12	14	9	15	15	16	11	14
17	13	10	7	12	13	14	12	15	10	8
18	13	19	12	13	14	15	13	16	13	9
19	14	12	6	11	13	14	13	14	10	11
20	11	11	11	14	14	17	11	12	13	12
21	13	11	8	10	16	15	14	16	11	11
22	7	6	11	14	11	10	14	14	14	14
23	17	19	14	12	13	14	15	18	12	10
24	12	13	12	17	15	17	12	12	10	10
25	10	13	14	17	12	15	10	10	12	16
26	11	13	8	12	15	15	18	17	11	13
27	13	17	12	15	14	16	13	12	12	11

APPENDIX E

Participant's Standard scores for the WIAT-II composite scales and full composite score.

Subject	Reading Composite	Mathematics Composite	Written Language Composite	Oral Language Composite	Total Composite
1	125	113	107	103	114
2	128	108	108	107	115
3	115	108	106	127	116
4	127	60	110	104	96
5	125	121	125	130	130
6	105	119	103	106	108
7	88	100	102	101	95
8	115	106	109	102	108
9	121	130	114	102	120
10	116	111	117	129	122
11	114	111	108	109	112
12	129	122	135	132	135
13	131	121	123	131	132
14	108	113	110	111	97
15	110	103	114	86	101
16	116	124	112	153	130
17	105	120	96	126	111
18	139	123	141	137	143
19	100	108	91	121	103
20	121	110	--	109	--
21	117	111	111	150	125
22	121	85	106	115	105
23	109	127	125	133	127
24	119	112	112	107	115
25	123	131	108	103	119
26	134	125	121	135	134
27	142	115	152	102	126