Do More Comprehensive Psychoeducational Evaluations Promote TBI Educational Diagnosis?

by

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ABSTRACT

Students with traumatic brain injury (TBI) sometimes experience impairments that can adversely affect educational performance. Consequently, school psychologists may be needed to help determine if a TBI diagnosis is warranted (i.e., in compliance with the Individuals with Disabilities Education Improvement Act, IDEIA) and to suggest accommodations to assist those students. This analogue study investigated whether school psychologists provided with more comprehensive psychoeducational evaluations of a student with TBI succeeded in detecting TBI, in making TBI-related accommodations, and were more confident in their decisions. To test these hypotheses, 76 school psychologists were randomly assigned to one of three groups that received increasingly comprehensive levels of psychoeducational evaluation embedded in a cumulative folder of a hypothetical student whose history included a recent head injury and TBI-compatible school problems. As expected, school psychologists who received a more comprehensive psychoeducational evaluation were more likely to make a TBI educational diagnosis, but the effect size was not strong, and the predictive value came from the variance between the first and third groups. Likewise, school psychologists receiving more comprehensive evaluation data produced more accommodations related to student needs and felt more confidence in those accommodations, but significant differences were not found at all levels of evaluation. Contrary to expectations, however, providing more comprehensive information failed to engender more confidence in decisions about TBI educational diagnoses. Concluding that a TBI is present may itself facilitate accommodations; school psychologists who judged that the student warranted a TBI educational diagnosis produce more TBI-related accommodations. Impact of findings suggest the importance of training school psychologists in the interpretation of neuropsychology test results to aid in educational diagnosis and to increase confidence in their use.

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TABLE OF CONTENTS

Page

LIST OF TABLES vii

LIST OF FIGURES viii

CHAPTER

1 DO MORE COMPREHENSIVE PSYCHOEDUCATIONAL EVALUATIONS PROMOTE TBI EDUCATIONAL DIAGNOSIS 1

Mechanisms of Injury 1

Severity of Injury 2

Incidence and Etiology 2

Individuals with Disabilities Education Improvement Act 3

2 LITERATURE REVIEW 7

Common Symptoms of TBI 7

Common TBI Symptoms in the Physical Domain 8

Common TBI Symptoms in the Cognitive Domain 12

Common Symptoms of TBI in the Behavioral Domain 18

Psychoeducational Evaluation 22

Educational Accommodations 23

TBI Educational Diagnosis and Special Education Services 24

Summary and Conclusions 27

Statement of the Problem 27

Research Questions and Hypotheses 28

CHAPTER Page

3 METHOD 30

Participants 30

Materials 31

Focus Group 35

Procedures 35

Inter-rater Reliability 37

Research Hypotheses and Analyses of Data 37

4 RESULTS 41

Demographic Statistics 41

Data Analysis 44

5 DISCUSSION 54

Implications for Practice 61

Limitations 63

Future Research 65

Conclusion 66

REFERENCES 68

APPENDIX

A LETTER TO PARTICIPANTS 71

B DIRECTIONS 74

C DESCRIPTION OF HYPOTHETICAL STUDENT AT THREE LEVELS 76

D SURVEY 85

APPENDIX Page

E VERBAL RECRUITMENT 93

F INSTITUTIONAL REVIEW BOARD APPROVAL - ARIZONA

STATE UNIVERSITY 95

G APPROVAL - SCOTTSDALE UNIFIED SCHOOL DISTRICT . 97

H APPROVAL - TEMPE ELEMENTARY SCHOOL DISTRICT .. 99

I FIGURES 102

LIST OF TABLES

Table Page

1. Definition of TBI according to IDEIA 8

2. Symptoms Expressed by Hypothetical Student in this Study 32

3. Levels of Assessment.. 34

4. Demographics of Participating School Psychologists 42

5. Effect of Increasing Levels of Psychoeducational Evaluation of Dependent Variables.. 43

6. Other Explanations Offered for the Student's Presentation 46

7. Significant Group Differences for Each Hypothesis........................... 53

LIST OF FIGURES

Figure Page

1. Histogram of ratings of confidence in educational diagnosis........... 103

2. Mean ratings of confidence in educational diagnosis across three levels of comprehensiveness of psychoeducational evaluation................ 104

3. Histogram of number of TBI-related accommodations.................... 105

4. Mean number of TBI-related accommodations across three levels of psychoeducational evaluation... 106

5. Histogram of confidence in educational accommodations............... 107

6. Mean ratings of confidence in educational accommodations across levels of comprehensiveness of psychoeducational evaluation 108

7. Mean number of TBI-related accommodations produced by school psychologists who choose TBI or non-TBI educational diagnosis.. 109

Chapter 1

DO MORE COMPREHENSIVE PSYCHOEDUCATIONAL EVALUATIONS PROMOTE TBI EDUCATIONAL DIAGNOSIS?

School psychologists play an important role in the assessment and identification of students who have sustained a traumatic brain injury (TBI), and in identifying ways to meet the needs of those students. This chapter reviews pediatric TBI, including etiology and mechanisms of injury; severity of injury; and how students qualify for TBI under the Individuals with Disabilities Education Improvement Act (IDEIA, 2004).

Mechanisms of Injury

Some basic concepts related to TBI are important for school psychologists to understand prior to conducting evaluations. Some of these concern mechanisms of injury. Broadly, there are two types of TBI; those arising from open and those arising from closed head injuries. An open head injury occurs when a skull is penetrated by a foreign object such as a bullet, or the skull is crushed or broken. In contrast, a traumatic injury to the brain inside an intact skull is known as a closed head injury. Damage to the brain in a closed head injury can occur not only at the point of impact, but also at an area opposite the point of impact, as the brain can rebound and impact backward. Injury can also be caused by movement or rotation of the brain inside the skull. This may result in complications such as bleeding in and around the brain (hemorrhage), a swelling mass filed with blood (hematoma), bruising (contusion), swelling of brain tissue (edema), or increased pressure inside the skull.

It is also helpful to know that brain injuries can be characterized as focal or diffuse. Focal injuries are those that occur at the primary point of impact. Brain trauma can also result in more widespread (diffuse) damage to the brain that includes stretching of nerve fibers and changes in the brain's precisely balanced biochemistry (Stavinola, 2005).

The effects of an injury may be the direct result of brain damage, or may be an indirect response to the injury (e.g., a reaction to the accident and to losses resulting from it). Vulnerable areas of the brain often affected during a closed head injury include the frontal lobe and anterior and medial portions of the temporal lobes. Therefore, there are features of acquired brain injury that are common to many children who sustain a TBI (Bowen, 2005).

Severity of Injury

TBI occurs along a continuum of severity, which holds implications for assessment and educational programming. Common methods to determine injury severity include the Glasgow Coma Scale, a widely used system to assess coma and impaired consciousness (Teasdale & Jennett, 1974), duration of impaired consciousness (e.g., Ewing-Cobbs et al., 1998), and findings on imaging studies (e.g., CT scan) at the time of injury (e.g., Anderson, Rose & Johnson, 1998). The current analogue study concerns a student with a moderate injury.

Incidence and Etiology

In 2000, Congress passed the Children's Health Act of 2000 (P.L. 106-310) requiring the Center for Disease Control and Prevention (CDC) to develop a national program of TBI registries. As a result, the CDC now reports average

U.S. TBI-related emergency room visits, hospitalizations, and deaths by age group.

Based on the CDC's data, there is a high incidence of TBI in the United States. Each year on average 1.7 million people in the United States sustain a TBI. Approximately 511,257 TBIs occur among children 0-14 years (CDC, 2010). Therefore, TBI is a condition likely to be encountered by those working in schools (Arroyos-Jurado, Paulson, Merrell, Lindgren & Max, 2000). In almost every age group (except ages 55-64 years), TBI rates are higher for males than for females.

Falls are the leading cause of a TBI for children, constituting 50% of TBI injuries among children 0-14 years. Motor vehicle accidents are the second leading cause (CDC, 2010). It is important to recall, however, that data compiled by national surveillance systems and reported by the CDC include only hospital emergency department visits and hospitalizations. Consequently, they do not include injured individuals who received medical care elsewhere such as outpatient clinics, or those who received no medical care at all. Therefore, CDC data may underestimate the true overall occurrence of TBIs.

Individuals with Disabilities Education Improvement Act (IDEIA)

In 1975, Public Law 94-142, the Education of the Handicapped Act (later reauthorized as the Individuals with Disabilities Education Act, IDEA, 2004) mandated special education services for students with disabilities. Students with disabilities are classified in 13 special education categories. IDEA (34 C.F.R. §300.7) defines children with disabilities as,

> …having mental retardation, hearing impairments including deafness, speech or language impairments, visual impairments including blindness, serious emotional disturbances, orthopedic impairments, autism, **traumatic brain injury,** other health impairments, specific learning disabilities, deaf-blindness, or multiple disabilities, and who because of those impairments need special education and related services (IDEA, 34 C.F.R. §300.8(a)(1)).

With the reauthorization of the Education of the Handicapped Act Amendments of 1990 (P.L. 101-476), signed and subsequently reauthorized in 1997 (U.S. Disabilities Education Improvement Act P.L. 108-446; U.S. Department of Education, 2004), the definition of children with disabilities was modified to include children with TBI. Subsequently, the definition of a TBI itself was published in the Federal Register (57-44794-01) in 1992. The impairments listed in the definition of TBI are important to this study, and will be discussed in detail later in this proposal. See Table 2. 34 C.F.R. Section 300.8 (b) 12 of IDEIA defines TBI as,

> …an acquired injury to the brain caused by an external physical force, resulting in total or partial functional disability or psychosocial impairment, or both, that adversely affects a child's educational performance. The term applies to open or closed head injuries resulting in impairments in one or more areas, such as cognition; language; memory; attention; reasoning; abstract thinking; judgment; problem-solving; sensory, perceptual and motor abilities; psychosocial behavior; physical

functions; information processing; and speech. The term does not apply to brain injuries that are congenital or degenerative, or brain injuries induced by birth trauma.

In addition, a student can be classified as having a TBI only if the features enumerated above "adversely affect educational performance." Also, it is noteworthy that the definition restricts TBI eligibility for services to students with open or closed head injuries (injuries caused by external force). The advent of the TBI category increased demands on school psychologists (and other school personnel) to accurately identify TBI-related impairments, prompt multi-disciplinary teams working in schools to conclude that an educationally-relevant TBI is present, and to subsequently see that schools provide services to those students who meet IDEIA eligibility criteria.

Some interesting trends have appeared since TBI appeared as an IDEIA category. State-reported data about students with disabilities served under IDEIA is collected and published by the Data Accountability Center (DAC; Office of Special Education Programs, U.S. Department of Education, 2010). Data on students with disabilities is available by age group, year, and disability category from 1998-2010. According to the DAC, a total of only 24,594 students age 6-21 were served in the TBI category in 2010, out of a total of 5,818,074 students with disabilities served across all disability categories. In contrast, the category with the largest number of students served in 2010 was specific learning disabilities (2,412,801). The number of children and students served under the TBI category in the 12-17 age group was just 6,603 in 1998, but rose gradually to 13,780 in

2010. The number of children and students served under the TBI category in the age group of 6-11 rose from 4,878 in 1998 to 8,050 in 2010 (DAC, 2010).

Although the number of students served under the TBI category has increased, the relatively few students served nationally under the TBI category (DAC, 2010) seems to imply one of two things. One possibility is that TBI is not adversely affecting the academic performance of many students who have sustained a head injury. The other possibility is that some students may not be recognized as needing services under the TBI category when in fact they do legitimately require such services.

The present analogue case study investigated whether school psychologists who obtain a more comprehensive psychoeducational evaluation are more likely to judge that a student has a TBI educational diagnosis and to identify TBI-related accommodations.

Chapter 2

LITERATURE REVIEW

This chapter reviews frequently cited symptoms of TBI in three domains; psychoeducational evaluation of domains of functioning related to TBI; educational accommodations for students with TBI; and studies of utilization of special education services for students with TBI. It concludes with research questions and hypotheses.

Common Symptoms of TBI

It is argued in the psychological and school psychology literature that symptoms of TBI can logically be grouped into physical, cognitive, and behavioral domains (e.g., Clark, 1996; Arroyos-Jurado, Paulsen, Merrell, Lindgren, & Max, 2000). If one examines the impairments included in the IDEA definition of TBI, the particular characteristics indicate TBI also falls logically into those three domains (see Table 2). Therefore, an evaluation that is sensitive to impairments in those areas would seem to represent the most reasonable way to determine if a student who has sustained a head injury qualifies for special education services in the TBI category under IDEA.

Table 1

Definition of TBI According to IDEIA

Broad category of functioning according to IDEIA definition	Specific features that may be present
Cognitive	Impairment in cognition, language, memory, attention, reasoning, abstract thinking, judgment, problem-solving, information processing, and speech.
Behavioral	Psychosocial impairment.
Physical	Impairment in physical functions, sensory, perceptual and motor abilities.

Because the symptoms expressed by students with TBI may guide assessment practices, the literature regarding these three domains of TBI symptomology is reviewed below.

Common TBI Symptoms in the Physical Domain

In the physical (somatic) domain, Hooper, et al. (2004) reported findings from a large-scale demonstration project of 1,250 North Carolina children with TBI served over a three-year period. Sixty percent (409) of the participants were seen in hospital emergency departments only, whereas forty percent (272) of the participants were actually admitted to hospital in-patient units. Overall, the sample had a relatively mild level of injury severity (i.e., 82.9% of the patients had a mild GCS score, 5.1% moderate, 12% severe). Families of children were contacted at one, four, and ten months post injury for a structured interview, during which they were questioned about the presence of neurological symptoms, among other topics. At four month follow-up, physical symptoms reported by caregivers of previously hospitalized children included dizziness (9.7%), headaches (22.6%), seizures (3.3%), nausea/vomiting (3.2%), balance (12.7%), vision problems (14.2%), and hearing problems (4.8%). By ten months, the percentages of parent endorsement dropped for most symptoms, but reports of headaches (27.3%), vision problems (16.7%) and hearing problems (8%) in the hospitalized group had actually increased. Fatigue was categorized as a behavioral symptom, with 17.5% of caregivers of hospitalized patients reporting patient fatigue at four months, and 18.2% reporting it at ten months. However, the study collected little data on the pre-injury functioning of the patients, as it was a clinical demonstration project. According to the authors, information on pre-injury functioning is not typically collected in a hospital setting (Hooper, et al., 2004). Furthermore, the base rates of these symptoms in the general (TBI-free population) are unknown. Nonetheless, it appears that children who had sustained a TBI in this study are at risk for a host of physical consequences that persist over months and may be educationally relevant.

In another study of physical symptoms after pediatric head injury, Greenspan and MacKenzie (2005) examined the consequences of head injury in 95 children aged 5 to 15 one year after they were hospitalized. Head injury severity was measured using the Glasgow Coma Scale and the Abbreviated Injury Scale (AIS), a measure based on anatomic (bodily) descriptors of the injury. AIS scores range from 1 (minor injury) to 6 (maximum injury). Twenty percent of the participants in the study had a severe injury, 12.6% had a moderate injury, 63% had a mild injury, and 4.2% did not indicate injury severity. Sources of data included a telephone survey of parents taken one year after the child's hospitalization, and information obtained from inpatient medical records. Physical health was also measured using the Rand Scale on physical Health in children. That scale was developed as a questionnaire for parents in the Rand Health Insurance Study, and consists of a composite scale derived from four subscales: role activity limitations (ability to participate in school and do whatever he/she would like to do), physical activity limitations (e.g., walking, running), self-care (e.g., dressing, bathing), and mobility limitations (ability to move freely). Twenty-three percent of the parents reported that their child had one or more chronic health problems before the TBI, and 8% reported major or developmental problems before the TBI (e.g., mental retardation or seizure disorders). At the time of the interview, one year after hospitalization, 55% of parents reported their child had one or more health problems. Headaches were the leading health problem reported (32%). Musculoskeletal or peripheral nerve disorders were reported by 13%, weakness, incoordination, or ataxia (loss of coordination of the muscles) were reported by 7%, vision, hearing or speech disorders were reported by 6%, and fatigue by 3%. Greater differences by severity were noted for specific problems. For example, children with AIS 5 injuries were far more likely to have weakness or incoordination (56%) and difficulties with vision, hearing, or speech (22%) than were children with AIS 2, 3, or 4 injuries (<5 reported in those areas). In a comparison of data with findings from a random selection of children aged 5 to 13 years from the Rand Health Insurance Study, mean composite and subscale scores were all significantly higher for the head-injured group. The authors state this finding suggests that the study population was far more likely to have limitations in physical health one year post-injury than were children from the general population. No comparison group was used. However, the authors suggest that severity of injury is related to health status, and that even children with minor and moderate head injuries were found to be in worse health (physical status) than the general population.

In another example of physical complaints in children and adolescents with head injury, Eviatar, Bergtraum, and Randel reported on 22 patients aged 6 to 18 years who were evaluated by physicians for post-traumatic vertigo (dizziness) and headache, nausea, vomiting, and visual disturbances. The purpose of the study was to report on clinical and laboratory tests that can help establish a definitive diagnosis and appropriate treatment for dizziness following trauma. The trauma suffered by the patients in the study was described as closed-head or neck injury. Clinical data from a 24 month period was obtained from a chart review of children seen within 72 hours of trauma with or without loss of consciousness. Over 50% of the patients complained primarily of dizziness (vertigo) or headache. The authors state that disturbance of the inner ear (cochlear and vestibular functions) is one of the most common type of late complication of head injury that can be objectively demonstrated by clinical and laboratory tests. They also contend that nausea and vomiting are often present with such symptoms. The authors also suggest that, while such symptoms subside in 4-6 weeks in most cases, signs of such dysfunction may still be detected many years after the injury. Therefore, this study also supports the presence of physical symptoms such as dizziness, headaches, and nausea following head injury.

Common Symptoms of TBI in the Cognitive Domain

In the cognitive domain, deficits frequently cited in the literature include memory impairments, disorders of attention, impairment in executive functions (e.g., organization, planning, problem solving), and decreased speed of information processing, as discussed below.

For example, in the area of memory impairments, Roncadin, Guger, Achibald, Barnes and Dennis (2004) reviewed performances on a verbal working memory measure (Recognition Memory Test, Goldman, Fristoe, & Woodcock, 1974) of 126 Canadian school-age children and adolescents who had been admitted to a hospital for head injury (40 mild, 46 moderate, and 40 severe injury). Inclusion criteria included head injury at least 1 year before testing and Verbal and Performance IQ scores above 70 on a standard test of intelligence (Wechsler, 1974, 1991). Results on the Recognition Memory Test showed working memory scores were significantly skewed toward the low end of the distribution among the moderate and severe injury groups, whereas the distribution comprised of scores from the mild group was symmetrical (normal). Though no comparison group was used, relative to the population mean (i.e., the 50th percentile), working memory scores of the severe and moderate groups were significantly below average ($t[39] = 5.11$, $p<.001$ and $t[45] = 2.53$, $p<.05$, respectively).

In another study of memory impairments following TBI, working memory in 62 children who sustained moderate-to-severe TBI was investigated by Conklin, Salorio, and Slomine (2008). Children with a documented neurodevelopmental disorder (e.g., spina bifida, cerebral palsy or autism), pre-injury diagnosis of mental retardation or prior brain injury were excluded from the study. A traditional performance measure was used (digit span backward) as well as parent report (Behavior Rating Inventory of Executive Function, BRIEF). The TBI group performed significantly worse than the normal sample on the digit span backward task [$t(59) = 5.49$, $p<0.001$]. Scaled scores for digit span backwards were below the average range (<7) for 46.9% of the sample. The TBI group also received significantly higher scores (indicating greater executive dysfunction) on the BRIEF Working Memory Index (WMI) compared to the normative sample [$t(35) = 7.82$, $p<0.001$]. T-scores for the BRIEF WMI Index were outside the average range (T>5) for 41.7% of the sample.

In another example of memory impairments that often follow TBI, Catroppa and Anderson (2002) in Australia examined memory skills at acute, six and twelve month stages following childhood TBI, using a prospective, longitudinal between group design. Participants were 76 children ages 8-12 years who had sustained a mild, moderate, or severe TBI. Exclusion criteria were history of developmental disorder and learning or attentional disability. In addition to pre-injury questionnaires (epidemiological, medical, and Vineland Adaptive Behavior Scale, VABS), measures included an intellectual measure (WISC-III), and three types of memory measures: immediate memory (Digits

Forward; Block Span); short-term memory/encoding (Luria Short Stories; Complex Figure of Rey, Recall); and multi-trial learning (Verbal Learning Test, WRAML). The association between injury severity and test performance across time points was reviewed. At acute evaluation, all severity groups performed at least 1 SD below age expectations on the verbal memory task, Luria story recall, when results were compared to age-scaled test norms [mild: 24.1 (1.4), moderate: 22.6 (1.3), severe: 21.5 (1.7)]. The mean scores for the mild and moderate groups improved to within 1 SD of the test mean by 12 months post-injury, but those of the severe group did not. For multi-trial memory and learning tasks, the severe TBI group performed most poorly, but the mild and moderate groups also demonstrated initial impairments. No comparison group was used in the study, but results were compared to age-scaled test norms. Results from the Vineland Adaptive Behavior Scale demonstrated that the TBI groups were functioning similarly post-injury. Therefore, the authors contended that post-injury differences may be interpreted with reference to injury-related factors. The authors further contended that although deficits in verbal memory and learning tasks skills showed recovery in the months following injury for children with less severe injury, those deficits may still impact day-to-day functioning initially and limit children's capacity to learn at pre-injury levels.

Also regarding TBI-related impairments in the cognitive domain, Tremont, Mittenberg, and Miller (1999) compared the performance of 30 children admitted to a trauma center due to head injury with the performance of matched orthopedic controls following initial hospitalization. Exclusion criteria included history of learning disability, ADHD, psychiatric/emotional disorder, previous loss of consciousness, or other neurologic disorder. The WISC-III was administered when subjects with a TBI emerged from post-traumatic amnesia. Orthopedically injured children were tested as soon as possible after admission. Although the majority of patients sustained mild injuries (73% according to GCS values), children with head injury performed significantly worse than the orthopedically injured children on all IQ measures, with Performance IQ showing the largest difference (approximately 13 points). On factor scores, Processing Speed showed the largest mean difference for the head injury group compared to orthopedic controls (approximately 15 points). This study suggests that impaired information processing speed may also be a cognitive sequelae of TBI.

Impairments in attention have been documented to be another consequence of TBI. For example, Anderson, Fenwick, Manly and Robertson (1998) in Australia examined four components of attention using the Test of Everyday Attention for Children (TEAch, Manly, Robertson & Anderson, 1998). Eighteen children with a moderate-to-severe TBI were compared to a non-injured control group. Exclusion criteria included pre-injury history of ADHD. Data indicated a trend for the TBI group to perform less efficiently than healthy controls. Scores on all attention measures showed poorer performance for the TBI group. Univariate F-tests also revealed that children with TBI were rated by their parents as significantly more inattentive ($F(1,34) = 18.02$, $p<0.001$) than non-injured controls. The authors contended the results suggest that children will experience persistent deficits in maintaining attention following moderate-to-severe TBI.

Impairment in executive function has also been documented to be a consequence of TBI. Sesma, Slomine, Ding, and McCarthy (2008) measured impairment in executive function in the first year of TBI. Caregivers of children aged 5 to 15 years were enrolled in a longitudinal study of executive function. There were 330 children with mild-to-severe TBI, and 103 controls with orthopedic fractures. The BRIEF was used to document changes in children's executive function in the first year. Caregivers completed the BRIEF at baseline retrospectively, and at three months and one year after injury. Although TBI groups and controls showed no baseline BRIEF differences, three months after injury, children with TBI had more dysfunction than controls on the BRIEF's Global Executive Composite. One year after injury, all TBI groups scored worse than controls on three BRIEF indexes – the Behavioral Regulation Index, Metacognition Index, and Global Executive Composite. Although mean BRIEF summary scores were not at the clinically significant level (>65), the authors concluded that between 19% and 38% of the children with TBI had significant executive dysfunction in the first year after injury, with greater dysfunction reported for children with more severe TBI.

Finally, in a meta-analysis of the literature, Babikian and Asarnow (2009) reviewed neurocognitive outcomes and recovery after pediatric TBI. Twenty-eight studies between 1988 and 2007 that reported descriptive group statistics or group differences were included. Complications such as methodological differences and a range of outcome measures made it difficult to combine and summarize date. However, Babikian and Asarnow analyzed finding for three sets of statistics: case-control studies (magnitude of the effect of injury severity over the course of three time bands), case-case studies (magnitude of the difference among severity groups over the course of three time bands), and longitudinal studies (magnitude of the change over time in neurocognitive domains across severity groups). Time period intervals were defined by three cutoffs: Time 1 (0-5 months post-injury), Time 2 (6-23 months post-injury) and Time 3 (24+ months post-injury). Findings for each severity group were reviewed. Regarding moderate TBI (the subject of this study), case control studies showed moderate to large effects for visual immediate memory through Time 2, with the differences significantly decreasing by Time 3. Large effects for FSIQ, VIQ and PIQ were present at Time 1, which decreased by later time points. Large effects were also noted for processing speed at Time 3. Case-case studies noted initial moderate to large effects for FSIQ, PIQ visual perception functioning, and attention, with the difference decreasing in magnitude over time. Longitudinal studies of FSIQ, PIQ, processing speed, attention, problem-solving and visual perceptual functioning showed some improvement (small to moderate) in the first two years post injury, with no observable changes thereafter. No improvements in VIQ or working memory were apparent. This study provides further support for the appearance of an array of cognitive impairments following TBI.

Common Symptoms of TBI in the Behavioral Domain

Behavioral symptoms have been documented to be another sequela of TBI. In the UK, for example, Andrews, Rose and Johnson (1998) compared 27 children with TBI (8 mild, 9 moderate, 10 severe) with 27 controls recruited from local schools, matched in sex, age, and socio-economic status to each child in the TBI group. Children with other neurological insult, evidence of abuse or neglect, psychological disorder, learning disability, or other developmental disorders were excluded. Measures included the Vineland Adaptive Behavior Scales (VABS) along with the DeBlois Aggressive and Antisocial Behavior Scales (DAABS) to measure the degree of aggressiveness, non-compliance, reactivity, antisocial behavior, depression, anxiety and egocentricity, as well as the Coopersmith Self Esteem Inventory (CSEI) and the Children's Loneliness Scale (CLS) as a measure of social function. A semi-structured interview was also conducted with each child's primary caregiver. Assessments were performed 0-5 years after injury, with mean time intervals between the accident and assessments similar across severity groups. Regarding the question of behavior performance, paired t-tests between the experimental and control groups showed significantly lower levels of self esteem ($t = -15.9$, $df = 53$, $p < 0.05$) adaptive behavior ($t = -7.1$, $df = 52$, $p < 0.05$), and significantly higher aggressive or antisocial behavior ($t = -19.3$, $df = 53$, $p < 0.05$).

In another study that included the determination of behavioral symptoms in children with TBI, Hooper, et al. (2004) reported on a large scale demonstration project involving 1,250 children with TBI in the State of North

Carolina. Caregivers reported on the presence of behavioral symptoms at one, four, and ten months post injury. In this study, 82.9% of the subjects had a GCS score indicating mild TBI, 5.1% indicating moderate TBI, and 12% indicating severe. About 10% of the overall sample was described by caregivers as having at least one behavioral symptom at the 1-month time point. The percentage with behavioral symptoms increased slightly to 11.8% at the 4-month time point, then dropped to 5.6% at the 10-month follow-up point. For the sample as a whole, the primary concern reported at the 1-month time point was sleep problems; at the 4-month point the primary concerns were low frustration tolerance and personality changes; at the 10-month point low frustration tolerance was a primary concern. For children who returned to school, about 9% were experiencing new learning and/or behavioral problems at the one-month time point, which increased to 15.2% at the four-month time point. About 10% of the students were reported to be experiencing a new learning and/or behavioral problem at school at the 10-month follow-up. However, there was little data on the pre-injury functioning of the participants, which means that it is not known how many students may have had such problems prior to the TBI.

Behavioral problems were also considered by Hawley (2004) in the UK during an investigation of the relationship between behavioral problems and school performance following TBI. This study compared 67 children with TBI (35 mild injury, 13 moderate, 19 severe) to 14 uninjured matched controls. Children were assessed using the Vineland Adaptive Behavior Scales (VABS) and the Wechsler Intelligence Scale for Children (WISC-III). Scores on the maladaptive behavior domain of the VABS were categorized as one of three levels: non-significant, intermediate, and significant. It was reported that 63.6% of the children with a mild TBI scored at the significant level on the maladaptive behavior domain of the VABS; 53.8% of children with moderate TBI and 70.6% of those with a severe TBI also scored at the significant level. However, only 18.2% of children in the control group scored at the significant level on the VABS. The study did not control for pre-morbid characteristics, but the author stated that none of the children were described by parents as having significant behavior problems prior to the TBI (Hawley, 2004). The percentage of scores reported at the "significant" level on the Maladaptive Behavior Scale of the VABS for children with TBI again provides support for the presence of behavioral symptoms among children who have sustained a TBI.

Social isolation is another problem in the behavioral domain. Prigatano and Gupta (2006) measured reported close friends in children ages 7 to 14 after TBI (14 severe, 10 moderate, 36 mild) compared to 16 trauma controls with orthopedic injury. The children with TBI were involved in an ongoing study of parental perceptions of recovery after TBI at St. Joseph's Hospital and Medical Center in Phoenix, Arizona. Children were included in the study based on a retrospective analysis of their medical records showing a documented GCS score at the time of admission. Parental reports were obtained regarding the number of close friends the child had one to two years after TBI on average. All of the children were enrolled in school at the time of the study. Results showed that 75% of control children were reported by their parents to have four or more close friends. The percentage of children with TBI having four close friends decreased as a function of severity of TBI (38.9% for mild, 20% for moderate, and 14.3% severe). Correlational analysis revealed that GSC score at admission correlated with the number of friends by parental reports ($r = 0.307$, $N = 76$, $P = .007$). The relationship was not purely linear though when parents reported the child having zero to one friend. While children with zero to one friend typically were in the categories of those with moderate to severe TBI (50% for moderate TBI and 21.4% for severe TBI), some children with mild TBI (19.4%) also were classified as having 0 to 1 friend. The study did not address the question of how many friends the children had before the TBI, as parents were often unable to give precise estimates. However, the authors suggested that more severe brain injury may be associated with fewer friends in the post-acute phase following TBI.

Thus studies have shown that students who have sustained a moderate TBI may have symptoms in the cognitive, physical, and behavioral domains. This study investigates whether school psychologists who obtain a more comprehensive psychoeducational evaluation of student's performance in those domains are more likely to judge that the student has a TBI educational diagnosis and that TBI-related accommodations should be provided. Therefore, the sections that follow will address psychoeducational evaluation, educational accommodations to assist in compensating for TBI-related deficits, and utilization of special education services for student with TBI.

Psychoeducational Evaluation

This study investigates whether a more comprehensive psychoeducational evaluation is more likely to prompt school psychologists to conclude that a TBI educational diagnosis is warranted in a student with pervasive TBI-related problems. Therefore, the types of assessments that may be used to assist in addressing mandatory aspects of the TBI definition are reviewed below.

Regarding the need for assessment that addresses all important areas of functioning, Ewing-Cobbs, Fletcher, Levin, Iovino, and Minor (1998) contend that results in a longitudinal study of the academic effects of TBI showed the insensitivity of individually-administered achievement tests scores to post-traumatic academic difficulties. They also argue that achievement test results likely significantly overestimate the ability of children with TBI to function in the regular academic environment. In that study, Ewing-Cobbs, et al. examined the relationship between injury severity and academic achievement scores in 38 children ages 5-10 years and 23 adolescents age 11-15 years, from six months to two years after injury. Criteria for inclusion included no indications of pre-injury developmental delay or diagnosed learning disability resulting in special education services. To assess academic achievement skills, the Wide Range Achievement Test (Jastak & Jastak, 1978) was administered. The Peabody Individual Achievement Test (Dunn & Markward, 1979) reading comprehension subtest was also used. With the exception of low average arithmetic scores in severely injured adolescents, one and two year follow-up achievement scores were in the average range for both mild-moderate and severe groups. However, an analysis of the actual type of class placement two years after TBI indicated significant academic difficulty for the severely injured group. Children with average achievement scores often failed a grade and/or required special education support. The authors contend that, in addition to traditional assessments (intelligence and achievement tests), neuropyschological evaluations should also be used to comprehensively assess the full impact of the injury on the child's functioning (i.e., measures of attention, memory, visual motor skills, psychomotor speed, problem-solving skills, adaptive behavior and psychological status).

Though IQ tests and achievement tests may be insufficient alone to determine the impact of a TBI, fortunately there are standardized psychometric instruments available to tap specific domains of functioning likely to be affected by neurological insult. Many of these have been developed specifically to add sensitivity for neurologically-based impairment to standardized IQ tests, and hence as a group are referred to as "neuropsychological instruments" (e.g., Clark, 1996). Thus, it appears that school psychologists possess an array of standardized instruments that might assist in addressing mandatory aspects of the TBI definition.

Educational Accommodations

Another important issue for school personnel, including school psychologists, is accommodating students with TBI. Moreover, in this study data was collected regarding accommodations that school psychologist-participants might use to assist a hypothetical student. Thus this topic is reviewed here.

An accommodation can be defined as an adjustment designed to assist a student in overcoming classroom and learning problems without the use of special education services or funding. No empirical studies were found that investigated the efficacy of specific educational accommodations for TBI in school. However, research studies exist in both the rehabilitation literature and intervention literature that focus on approaches to assist those with TBI in compensating for TBI-related deficits (e.g., Slomine & Locascio, 2009). There is also a body of research on effective strategies for children with learning disabilities who have deficits in domains that also characterize children with TBI (e.g., memory, attention; Ylvisaker et al. 2001). Therefore, commentators (e.g., Bowen , 2005) have identified instructional strategies, supports, and aids often used to assist students in overcoming common symptoms in TBI domains. Some of those adjustments may be used as classroom accommodations.

TBI Educational Diagnosis and Special Education Services

The relatively small number of students served under the TBI category nationally may imply some students who incurred a TBI may not be recognized as needing services in the TBI category. Studies have investigated utilization rates of special education services for students with TBI.

First, McCaleb (2006) studied the disability categories assigned to special education students in three Colorado school districts who were identified by parents as having a brain injury. Students with brain injuries were identified out of parental responses to questionnaires mailed to computer- generated samples of parents, including a sample (1,866 students) drawn from students who received special education services. The sample had a 21% response rate. The questionnaire consisted of 11 questions, including whether the student had a brain injury, and all disability categories for which the student was receiving special education services. No date of injury or severity level was reported, and the survey was not a diagnostic tool. Forty-nine parents (2.6%) in the sample indicated their child had been identified as having a brain injury. Forty of those parents reported a disability category under which their child was receiving special education services. Of those 40 students, 13% (5) were reported to be receiving special education services under the TBI disability category. Four of those five students receiving services in the TBI disability category were also reported as receiving services under additional disability categories. The most frequently identified single disability categories for those identified as having a brain injury were "other" (18%), followed by "speech-language" (10%). McCaleb argues that accurate identification and support for students with brain injury is critical to a student's overall educational success. She suggests that the results raise questions regarding TBI identification, non-identification, and mis-identification in schools, and whether students with brain injury are receiving the support they need.

Second, Taylor et al. (2003) also investigated rates of placement of students with TBI in special education programs. Their study included 42 children with severe TBI, 42 with moderate TBI, and 50 with orthopedic injury. A baseline assessment was done soon after the injury, with follow-up assessments conducted 6 and 12 months after the baseline, and at an extended follow-up about four years post injury. Frequencies of special education for each group were calculated at each time point, controlling for sex, socioeconomic disadvantage, and the presence/absence of special education placement immediately prior to injury. Of the 134 children in the study, 27 with TBI were in special education and seen at extended follow-up (21 severe, 6 moderate). They received the following eligibility classifications: 12 out of 27 were classified as specific learning disabilities (44%), 10 as TBI (37%), 2 as developmental handicap (7%), 1 as severe behavior handicap (4%), 1 as speech or language impairment (4%), and 1 as other health impaired (4%). Both TBI groups, along with those who were terminated from such programs, were included in a subset of children who were not in special education despite residual deficits shown by neuropsychological testing. At the 6 month follow-up, 12 of 52 children (23%) who were not in special education programs had deficits, including deficits in behavior (8), neuropsychological deficits (2), and multiple deficits (2). Five also had academic deficits. At the extended follow-up, 12 of 57 children not in special education programs had deficits, including 10 with behavioral problems, 4 with neuropsychological deficits, and one with multiple deficits. Taylor et al. suggested that discovery of deficits in several children with moderate TBI at the extended follow-up indicates that those children may be especially likely to escape attention, and that findings cast doubt on the adequacy of special education identification procedures.

The study by Taylor et al. (2003) also included frequencies of classroom accommodations prior to injury and at each follow-up. At the 6 month follow-up, the rate of accommodations were 54% for the severe group (21/39), 29% for the moderate group (12/41) and 15% for the ortho group (7/46). By the time of extended follow-up, the rate of accommodations were 62% for the severe group (26/42), 31% for the moderate group (13/42) and 50% for the ortho group (25/50). However, the accommodations were found to be of limited scope (i.e., alternative testing procedures and modified seating arrangements).

Thus, it appears that the TBI special education category may be under-utilized, and that students with head injuries may not be receiving appropriate educational accommodations.

Summary and Conclusions

Students who have sustained a TBI may return to school with physical, cognitive, and behavioral impairments that can affect their academic performance or disrupt their learning (Bowen, 2005). IDEIA (2004) mandates special education services for children with 13 disabilities, including TBI, if impairments listed in the law are persistent and adversely affect educational performance.

The data, however, show that relatively few students with head injuries are identified under the TBI label (DAC, 2010). Therefore, the IDEA category designed to ensure specialized services for students with TBI may be underutilized. Furthermore, appropriate accommodations may not be routinely provided.

Statement of the Problem

Little research to date concerns how often TBI is recognized by school psychologists and how they accommodate such students. In particular, it is unknown whether a more comprehensive evaluation of symptoms by school psychologists in three common domains (cognitive, behavioral and physical) would improve identification of a student with TBI and facilitate their receipt of TBI-related accommodations.

This study investigates the ability of school psychologist to recognize that a student qualifies for a TBI educational diagnosis and to choose TBI-related accommodations to meet the needs of such a student. The goal of the study is to learn whether school psychologists who obtain a more comprehensive psychoeducational symptomatic evaluation of a student in the domains where functioning is commonly impaired are more likely to determine that the student has a TBI educational diagnosis. A second goal is to determine whether a more comprehensive psychoeducational evaluation would lead to the selection of more educational accommodations that match TBI-related needs.

Research Questions and Hypotheses

1. In the presence of a student with sequelae of a closed head injury, does a more comprehensive psychoeducational evaluation lead to a higher rate of TBI educational diagnosis by school psychologists?

Hypothesis: Increasing comprehensiveness of psychoeducational evaluation will lead to a higher rate of TBI educational diagnosis.

2. In the presence of a student with a sequelae of a closed head injury, does a more comprehensive psychoeducational evaluation lead to a higher level of confidence by school psychologists in their educational diagnosis?

Hypothesis: Increasing comprehensiveness of psychoeducational evaluation will result in a higher level of confidence by school psychologists in their educational diagnosis.

3. In the presence of a student with sequelae of closed head injury, does a more comprehensive psychoeducational evaluation lead to school psychologists producing a higher number of TBI-related classroom educational accommodations?

Hypothesis: Increasing comprehensiveness of psychoeducational evaluation will lead to a higher number of TBI-related educational accommodations.

4. In the presence of a student with sequelae of a closed head injury, does a more comprehensive psychoeducational evaluation lead to a higher level of confidence by school psychologists in the educational accommodation(s) they produce?

Hypothesis: Increasing comprehensiveness of psychoeducational evaluation will result in a higher level of confidence by school psychologists in the educational accommodation(s) they produce.

5. Does a TBI educational diagnosis by school psychologists lead to producing a higher number of TBI-related classroom educational accommodations?

Hypothesis: More accurate recognition of a TBI educational diagnosis by school psychologists will result in more TBI-related educational accommodations.

Chapter 3

METHOD

This chapter includes the study's participants, materials, data collection procedures, and processes to analyze the results.

Participants

Participants were 76 school psychologists recruited from three school districts in the State of Arizona during the 2011-2012 school year, including the Scottsdale Unified School District, the Paradise Valley Unified School District, and the Tempe Elementary School District. Exclusion criteria consisted of school psychologists who participated in a focus group for this study. Participants were asked to participate during meetings of school psychologists in each district. Approval for the researcher to attend the district meetings was requested and received from each school district (see Appendix F-H). The demographic characteristics of participants were obtained by questionnaire, and included number of years worked as a school psychologist, the settings in which they work, the highest educational degree they obtained, their age range, and gender. These data are reported with findings.

A statistical power analysis was done to determine the minimum number of participants needed for the study to be informative. The minimum sample size needed to detect differences in three groups with a large effect size value ($r = .05$) is 66 participants, with a power of .80. With 76 participants, the study has sufficient power to detect differences with a large effect.

Materials

Materials consisted of a written packet of information distributed to each participant (see Appendix A-E). The written packet contained the following information: (a) a letter to the participants describing the study and soliciting their consent to participate, (b) directions regarding procedures to be followed, (c) a description of a hypothetical student who sustained a head injury, with each packet to contain one of three levels of increasingly comprehensive psychoeducational evaluation, (d) a survey questionnaire containing items about the student's educational diagnosis, accommodations to assist the student, and demographic information about the participant, and (e) verbal recruitment information.

The description of the hypothetical student contained classroom concerns compiled from frequently-cited symptoms of TBI in the literature in three domains: cognitive, behavioral and physical (see Table 2). It is noteworthy that the presenting symptoms associated with TBI are also associated with a variety of psychiatric problems, developmental disorders, temperamental differences, and student behavioral variations.

Table 2

Symptoms Expressed by Hypothetical Student in this Study

Concerns		Symptoms expressed by student		
Basic	Changes in academic performance.	Increased absences from school.		
Cognitive	Forgets homework; does not follow verbal instructions.	Performs poorly on math tests.	Not paying attention, staring out window.	Decreased speed in reading and in completing assignments.
Psycho-social behavior	Angry reaction with temper outbursts.	Aggressive behavior toward peers.	Few friends when was previously social.	Defiance in response to requests of teacher; decreased compliance.
Physical	Falling asleep in class; sleeping problems at home.	Complaints of headaches and upset stomach.	Possible sensitivity to noise. (Leaving in middle of music class.)	

The description of the hypothetical student also contained one of three levels of psychoeducational evaluation. Each level more fully represented a comprehensive evaluation able to detect the sequelae of the student's head injury. The first level, pre-evaluation, contained basic information about the student from his cumulative folder, along with attempts at problem solving made by the student's teachers. The second level, a basic psychoeducational evaluation typically done by school psychologists, included scores on the Wechsler Intelligence Scale for Children (WISC-IV, 2003) and achievement scores on the

Woodcock-Johnson Test of Achievement III (WJ III ACH, 2001). The third level, a comprehensive psychoeducational evaluation, included scores in other domains, including the Behavior Assessment System for Children (BASC-2, 2004), the Wide Range Assessment of Memory and Learning (WRAML-2, 2003), the Grooved Pegboard Motor Exam (GPME, 1993), the Rey-Osterrieth Complex Figure (Rey-OCF, 2003), the Comprehensive Trail Making Test (CTMT, 2002), and the Controlled Oral Word Association-FAS (COWAT-FAS, 1994). Therefore, the comprehensive level may be able to reveal most completely the sequelae of the head injury (see Table 3).

Table 3

Levels of Assessment

Potential domains of impairment under IDEIA definition)	Pre-evaluation	Basic evaluation	Comprehensive evaluation
Cognition	NA/AI	WISC-IV	WISC-IV
Reasoning	NA/AI	WISC-IV	WISC-IV
Abstract thinking	NA/AI	NA/AI	Rey-Osterrieth CF
Problem solving	NA/AI	NA/AI	Rey-Osterrieth CF Trail Making Test
Processing	NA/AI	WISC-IV	WISC-IV
Language	NA/AI	WJ III WISC-IV	WJ III WISC-IV COWAT-FAS
Working memory	NA/AI	WISC-IV	WISC-IV WRAML-2
Declarative memory	NA/AI	NA/AI	WRAML-2
Attention	NA/AI	NA/AI	Trail Making Test
Judgment	NA/AI	NA/AI	Rey-Osterrieth CV
Psycho-social behavior	NA/AI	NA/AI	BASC-2
Physical-sensory	NA/AI	NA/AI	Grooved Pegboard

Note: NA/AI = Not assessed or assessed informally

Development of scores on assessments of the hypothetical student was done in consultation with a pediatric neuropsychologist, including a review of completed neuropsychological evaluations of children in the same age group who sustained a moderate TBI. The scores reflect a pattern characteristic of a moderate TBI in a student of middle school age.

Focus group

Regarding development of case information, an expert focus group was used consisting of five school psychologists who possess knowledge of the symptoms of childhood TBI, of the disability categories under IDEIA, assessment, and accommodation. Members of the focus group were asked to read each level of the psychoeducational evaluation, then complete the survey form for each one. A majority of the focus group recognized the described symptoms of the student and assessment scores at the comprehensive evaluation level as characteristic of an educational diagnosis that satisfies the definition of a student with a TBI disability under IDEIA. No modifications were made in the description of the hypothetical student based on the results of the focus group, though slight changes were made in the survey to increase clarity.

Procedures

This study began after approval of the Arizona State University Institutional Review Board (Appendix F.) Written approval was obtained to recruit participants in the Scottsdale Unified School District and Tempe Elementary School District (Appendix G-H), and verbal approval was received from the Lead School Psychologist at Paradise Valley Unified School District.

A letter of invitation to participate in the study (Appendix A) was provided to prospective participants during regularly scheduled meetings of school psychologists in each school district. An offer was made in each district to place the names of school psychologists in a $50 gift raffle as thanks for their participation. Packets were randomly distributed to participants. Informed consent was obtained from each prospective participant by reading a statement about the research and returning a completed survey. Participants were asked to read through the information presented and to respond to the survey questionnaire as if he/she were a school psychologist making a decision on the student's eligibility for services according to IDEIA.

Participants were provided with fourteen choices from which to make an educational diagnosis. The choices comprised the 13 special educational categories under IDEIA, as well as the choice of no special education diagnosis. Participants were also asked to generate classroom accommodations that would be effective to address the student's educational needs, and to briefly state the reason for the accommodation. They were also asked to rate their confidence in the disability category they selected and in the effectiveness of the accommodations they produced.

Accommodations were counted as TBI-specific if they met all of the following criteria: (a) the accommodation would circumvent a TBI-related impairment in one of the functional areas listed in the IDEIA definition, and (b) the accommodation was appropriate in a regular education classroom setting without the use of special education services or funding, and (c) the rationale given for the accommodation did one or more of the following: (i) referred to or addressed one of the functional areas of IDEIA or could reasonably be interpreted as doing so, or (ii) referred to a sign or symptom expressed by the student (see Table 2) at the information level of the participant (e.g., difficulty following directions at information Level 2), or (iii) referred to a standardized assessment score for the hypothetical student at the information level of the participant (e.g., fluency on the Woodcock-Johnson III ACH at Level 2). If a participant provided multiple rationales for an accommodation, it was counted as TBI-specific if at least one rationale met the criteria. General accommodations (e.g., additional testing time) were not counted as TBI-specific unless the reason for the accommodation met the criteria.

Inter-Rater Reliability

A school psychologist with knowledge of classroom accommodations independently counted the TBI-related accommodations on 26% (N=20) of the survey forms. The accommodations counted as TBI-related by the two raters were compared. The percentage of agreement between the two raters resulted in a level of inter-rater reliability of 94%, well above the minimum level of reliability of 70.

Research Hypotheses and Analyses of Data

This study uses a between subjects design. The independent variable in this study is the comprehensiveness of the psychoeducational evaluation. There are three levels of psychoeducational evaluation (See Table 3).

There are three dependent variables: (1) the correct diagnosis of a TBI educational diagnosis under IDEA (dichotomous choice, either a TBI educational diagnosis or other choice), (2) the number of TBI-related accommodations produced, and (3) participant's ratings of their confidence level in both their educational diagnosis and in the accommodations (participant's values range from 1-5). Those variables are measured by survey questions asked of the participants. Other supplemental variables include the demographic responses.

The statistical analysis was conducted as follows:

Research question 1: Does a more comprehensive psychoeducational evaluation lead to higher rates of a TBI educational diagnosis by school psychologists?

To answer the first research question, participants made the choice of a correct or incorrect TBI educational diagnosis. The research question was addressed by logistic regression. It was hypothesized that increasing comprehensiveness of psychoeducational evaluation would lead to a higher rate of TBI educational diagnosis.

Research question 2: Does a more comprehensive psychoeducational evaluation lead to a higher level of confidence by school psychologists in their educational diagnosis?

The research question was addressed by conducting an *ANOVA*. The independent variable was the level of comprehensiveness of the psychoeducational evaluation. The dependent variable was the participant's confidence rating in their educational diagnosis. It was hypothesized that increasing comprehensiveness of psychoeducational evaluation would result in a higher level of confidence by school psychologists in their educational diagnosis. In light of possible problems using parametric tests (*ANOVA*), a non-parametric test procedure (Kruskal-Wallis) was also used.

Research question 3: Does a more comprehensive psychoeducational evaluation lead to school psychologists producing a higher number of TBI-related educational accommodations?

To answer the third research question, the independent variable was the level of comprehensiveness of the psychoeducational evaluation. The dependent variable was the number of TBI-related educational accommodations produced. The research question was addressed by conducting an *ANOVA* and post-hoc comparisons. In light of possible problems using parametric tests (*ANOVA*), a non-parametric test procedure was also used (Kruskal-Wallis). It was hypothesized that increasing comprehensiveness of psychoeducational evaluation would lead to a higher number of TBI-related educational accommodations. The direction of the effect was expected to increase with a more comprehensive evaluation, with an alpha level of .05.

Research question 4: Does a more comprehensive psychoeducational evaluation lead to a higher level of confidence by school psychologists in the educational accommodation(s) they produce?

The fourth research question was also addressed by conducting an *ANOVA*. The independent variable was the level of comprehensiveness of the psychoeducational evaluation. The dependent variable was the participant's confidence rating in the accommodations. It was-hypothesized that increasing comprehensiveness of psychoeducational evaluation would result in a higher level of confidence by school psychologists in the educational accommodation(s) they produce. In light of possible problems using parametric tests (*ANOVA*), a non-parametric test procedure was also used (Kruskal-Wallis).

Research question 5. Does a TBI educational diagnosis by school psychologists lead to producing a higher number of TBI-related educational accommodations?

To answer the fifth research question, a T-test was conducted. The independent variable was whether a TBI educational diagnosis was made. The dependent variable was the number of TBI-related accommodations. It was hypothesized that more accurate recognition of a TBI educational diagnosis by school psychologists will result in more TBI-related educational accommodations. In light of possible problems using parametric tests (t test), a non-parametric test procedure was also used (Mann-Whitney U Bonferroni).

Chapter 4

RESULTS

Demographic Statistics

The sample for this study comprised 76 practicing school psychologists divided into three groups. Group 1 (Pre-evaluation Level) had 25 participants, Group 2 (Basic Evaluation Level) 26 participants, and Group 3 (Comprehensive Evaluation Level) 25 participants. Seven surveys were not used as they were incomplete and/or completed in a manner inconsistent with directions.

Across all three levels, there were 61 females (80%) and 15 males (20%). Twenty-four participants were in the age range of 25-34 (31.5%), 23 in the age range of 35-44 (30.2%), 13 in the age range of 45-54 (17.1%), and 16 age 55 and over (21%). Regarding education, 26 participants reported a masters degree (34.2%), 19 a specialist degree (25%), 23 a PhD (30.3%), 2 an EdD (2.6%), and 6 a PsyD (7.9%). Regarding experience working as a school psychologist, 21 participants reported 5 years or less (27.6%), 23 reported 6-10 years (30.3%), 15 reported11-15 years (19.8%), 5 reported16-20 years (6.6%), 3 reported 21-25 years (3.9%) and 9 self-reported more than 25 years (11.8%). Regarding setting, 3 participants indicated working in a preschool (3.9%), 24 an elementary school (32%), 11 in a middle school (14.5%), 10 in a high school (13.2%), one was not working in a school (1.3%), and 27 reported that they worked in multiple settings (36%). See demographic data in Table 4 for details.

Table 4

Demographics of Participating School Psychologists

Category	Specific group	Group 1 (Pre)	Group 2 (Basic)	Group 3 (Comprehensive)	Total number
Gender	Female	18 (72%)	23 (88%)	20 (80%)	61
	Male	7 (28%)	3 (12%)	5 (20%)	15
Age range (years)	25-34	9 (36%)	9 (35%)	6 (24%)	24
	35-44	5 (20%)	9 (35%)	9 (36%)	23
	45-54	3 (12%)	6 (22%)	4 (16%)	13
	55+	8 (32%)	2 (8%)	6 (24%)	16
Work setting	Preschool	2 (8%)	0 (0%)	1 (4%)	3
	Elementary	5 (20%)	10 (38%)	9 (36%)	24
	Middle	4 (16%)	4 (15%)	3 (12%)	11
	High	2 (8%)	4 (15%)	4 (16%)	10
	Other	1 (4%)	0 (0%)	0 (0%)	1
	Multiple	11 (44%)	8 (31%)	8 (32%)	27
Highest degree	Masters	8 (32%)	8 (31%)	10 (40%)	26
	Specialist	5 (20%)	11 (42%)	3 (12%)	19
	PhD	11 (44%)	6 (23%)	6 (24%)	23
	Ed D	0 (0%)	0 (0%)	2 (8%)	2
	Psy D	1 (4%)	1 (4%)	4 (16%)	6
Years experience	0-5	9 (36%)	8 (31%)	4 (16%)	21
	6-10	4 (16%)	9 (37%)	10 (40%)	23
	11-15	4 (16%)	7 (27%)	4 (16%)	15
	16-20	3 (12%)	0 (0%)	2 (8%)	5
	21-25	0 (0%)	1 (4%)	2 (8%)	3
	25+	5 (20%)	1 (4%)	3 (12%)	9

Before research questions are answered, descriptive statistics are provided for all variables (see Table 5). Each of the research questions are then answered in turn.

Table 5

Effect of Increasing Levels of Psychoeducational Evaluation on Dependent Variables

	Level of psychoeducational evaluation								
Dependent variable	Pre-evaluation			Basic			Comprehensive		
Selection of TBI as educational diagnosis (Hypothesis 1)	20.0%			34.62%			56.0%		
	M	Mdn	SD	M	Mdn	SD	M	Mdn	SD
Self-rated confidence in diagnosis (Hypothesis 2)	3.64	3.67	.76	3.92	4.05	.93	3.76	3.81	.97
Number of TBI-related accommodations (Hypothesis 3)	1.80	1.60	1.08	3.62	3.50	1.86	3.80	3.77	1.50
Self–rated confidence in accommodations (Hypothesis 4)	3.70	3.70	.82	4.33	4.42	.79	4.19	4.31	.91

	If TBI educational diagnosis was selected			If TBI educational diagnosis was not selected		
	M	Mdn	SD	M	Mdn	SD
TBI-related accommodations (Hypothesis 5)	1.50	1.26	1.44	3.07	3.13	1.80

Note: Confidence self-rated 1-5 on a Likert-style scale. 5 (*very confident*); 4 (*somewhat confident*); 3 (*between confident and unsure*); 2 (*somewhat unsure*); 1 (*very unsure*).

Data Analysis

Regarding research question 1 (Does a more comprehensive psychoeducational evaluation lead to higher rates of a TBI educational diagnosis by school psychologists?) a logistic regression was employed, using the level of evaluation comprehensiveness as the predictor variable. It was hypothesized that increasing comprehensiveness of psychoeducational evaluation would lead to a higher rate of TBI educational diagnosis. Assumptions for the use of logistic regression were met (a between subjects design with two discrete alternative choices of TBI or non-TBI selection, no missing data or outliers, each participant received information only at one level, and sufficient sample size.) Comprehensiveness of evaluation did indeed reliably predict whether or not participants selected TBI from among the choices of educational diagnosis (chi^2 = 7.174, p = .029, df = 2; see Table 5). However, the strength of the relationship was not strong (Nagelkerke's R^2 = 0.123). Prediction success overall was 67.1% (77.1% for non-TBI diagnosis and 50% for TBI diagnosis). The predictive value came from the variance between Group 1 (Pre-evaluation Level) and Group 3 (Comprehensive Evaluation Level; Wald x^2 = 6.432, p = .011). However, the variance between Group 1 (Pre-Evaluation Level) and Group 2 (Basic Evaluation Level) failed to make a significant contribution (Wald x^2 = 1.341, p = .247). *EXP(B)* value indicates that when the psychoeducational evaluation is increased in comprehensiveness from the Pre-evaluation Level to the Basic Evaluation Level, the odds ratio is 2.12 times as large. Likewise, *EXP(B)* value indicates that when the psychoeducational evaluation is increased in comprehensiveness from the Pre- evaluation Level to the Comprehensive Evaluation Level, the odds ratio is 5.09 times as large, and when the psychoeducational evaluation is increased in comprehensiveness from the Basic Evaluation Level to the Comprehensive Evaluation Level, the odds ratio is 2.40 times as large. Research hypothesis 1 was supported.

Regarding a supplemental question (If you checked "none" in question one above, do you have an explanation for John's presentation?), participant responses are contained in Table 6.

Table 6

Other Explanations Offered for the Student's Presentations

Explanation	Frequency Mentioned (N)
Middle School	
Recent move may be troublesome	3
New expectations regarding middle school	1
Puberty	1
Change in environment	1
Typical adjustment in transitioning to middle school	1
Difficulties adjusting to middle school	2
Needs organizational skills support	1
Possible lack of motivation, uninterested	2
Possible test anxiety	1
Absenteeism	1
Possible drug use	4
Gang involvement	1
Something going on at home or socially, family issues	2
Emotional problems, but not a disability	1
Internalizing problems, anxiety	1
Traumatic event such as injury or parental separation	1
Reaction to bike accident	1
Emotional disability	1
Specific learning disability	1
ADHD	1
Executive functioning issues	1
Weaknesses in areas not necessarily deficits	3

Regarding research question 2 (Does a more comprehensive psychoeducational evaluation lead to a higher level of confidence by school psychologists in their educational diagnosis?), a one-way *ANOVA* was considered for statistical analysis. Confidence was measured with single five-point Likert-type items. Before conducting this analysis, the data were examined regarding normality of distribution. The data appeared to be negatively skewed (see Appendix I1). The Shapiro-Wilk test was utilized to further examine the distribution of the data. The Shapiro-Wilk test was significant (.85, $p < .01$), which further supports the notion that the assumption of normality is not satisfied. Consequently, a log transformation was then considered. Such a transformation, however, was ultimately abandoned because log transformation is not recommended for data with assigned intervals such as characterized this Likert-type item as logs of scales assigned different intervals (e.g., 0-4 or 1-5) will not reach the same conclusion (Nevill & Lane, 2007). In light of these facts, an *ANOVA* was conducted for tentative interpretation. The *ANOVA* was not significant, $F(2, 73) = .65$, $p = .53$. The strength of relationship between evaluation comprehensiveness and school psychologists' confidence was weak ($\eta^2 = .017$). The means and standard deviations for the levels of evaluation are reported in Table 5 (see also Appendix I2). In light of the possible problems using parametric tests *(ANOVA*), a non-parametric test procedure was used (Kruskal-Wallis) for tentative interpretation. The data were ranked in SPSS for the non-parametric test. Like the parametric tests above conducted regarding hypothesis 2, the Kruskal-Wallis Test was not significant, $\chi^2(2, N = 76) = 2.24$, *p*

= .33. This means that school psychologist-participants' rank of confidence was the same across the independent variables. Research hypothesis was not supported.

Regarding research question 3 (Does a more comprehensive psychoeducational evaluation lead to school psychologists producing a higher number of TBI-related educational accommodations?), a one-way *ANOVA* was considered. Before conducting this analysis, the data was examined regarding the assumption of normality of distribution of the number of accommodations. The data appeared to be positively skewed (see Appendix I3). A Shapiro-Wilk test was significant, indicating the assumption of normality is not satisfied (.77, $p <$ .01). Consequently, a log transformation of the data for number of accommodations (the dependent variable) was performed, but the transformation still failed to normalize the distribution. Nonetheless, an *ANOVA* with the original (non-log transformed) data was conducted (see Appendix I4). The *ANOVA* was significant, $F(2, 73) = 13.32$, $p < .01$, and the strength of relationship was strong ($\eta^2 = 26.7\%$). In anticipation of evaluating pair-wise differences among the means, the data were again examined to determine if assumptions for such tests were satisfied. The homogeneity of variance was not significant, $F(2,73) = 3.07$, $p = .05$. Therefore, post-hoc comparisons were conducted with the use of the Dunnett's C Test, a test that does not assume equal group variances. Results showed a significant difference in the means of Groups 1 and 2 (Pre-evaluation Level and the Basic Evaluation Level). There was also a significant difference in the means of Groups 1 and 3 (Pre-evaluation Level and the

Comprehensive Evaluation Level), but not between the means of Groups 2 and 3 (Basic and Comprehensive Levels). Therefore, as evaluation comprehensiveness increased from the Basic to the Comprehensive Level, there were not corresponding changes in all group means.

In light of the possible problems using parametric tests (*ANOVA*), a non-parametric test procedure was used (Kruskal-Wallis) for tentative interpretation. The data were ranked in SPSS for the non-parametric test, and the Kruskal-Wallis Test was significant, $\chi^2(2, N = 76) = 22.90, p > .01$. Follow-up tests were conducted to evaluate pair-wise differences among the three groups, controlling for Type I error across tests by using the Mann-Whitney *U* Test Bonferroni approach. Significant differences were found between the means of Groups 1 and 2 (Pre-evaluation Level and Basic Evaluation Level) and Groups 1 and 3 (Pre-evaluation Level and Comprehensive Evaluation Level), but not between the means of Groups 2 and 3 (Basic and Comprehensive Levels). Therefore, the results were the same as the *ANOVA* results above, indicating that increasing the comprehensiveness of the evaluation from the Basic Level to the Comprehensive Level did not produce a significant difference in the means of Groups 2 and 3. Research hypothesis was only partially supported.

Regarding research question 4 (Does evaluation comprehensiveness lead to a higher level of confidence by school psychologists in the educational accommodation(s) they produce?) a one-way *ANOVA* was considered for statistical analysis. A single five-point Likert type item was used to measure confidence. Before conducting the *ANOVA*, the data were examined regarding normality of distribution; the data appeared to be negatively skewed (see Appendix I5). The Shapiro-Wilks test was utilized to further examine this distribution. The Shapiro-Wilks test was significant (.82, $p < .01$), further supporting the notion that the assumption of normality is not satisfied. Consequently, a log transformation was then considered. Such a transformation, however, was ultimately abandoned because log transformation is not recommended for data with assigned intervals such as characterized this Likert-type item, as logs of scales assigned different intervals (e.g., 0-4 or 1-5) will not reach the same conclusion (Nevill & Lane, 2007). In light of these facts, an *ANOVA* was conducted for tentative interpretation. The *ANOVA* was significant, $F(2, 267) = 12.12$, $p < .01$ (see Appendix I6). The strength of relationship between the evaluation comprehensiveness and number of educational accommodations was moderate (η^2 =.0823). Follow-up tests were conducted to evaluate pair-wise differences via the Dunnett's C (which does not assume that the population variances are equal). There was a significant difference in the mean scores of Groups 1 and 2 (Pre-evaluation and Basic Evaluation Levels) and between Groups 1 and 3 (Pre-evaluation and Comprehensive Evaluation Levels). However, means for Groups 2 and 3 did not significantly differ.

In light of the possible problems using parametric tests (*ANOVA*), a non-parametric test procedure was used (Kruskal-Wallis) for tentative interpretation. The data was ranked in SPSS for the non-parametric test. The Kruskal-Wallis Test was significant, $\chi^2(2, N = 270) = 13.91$, $p > .01$. Follow-up tests were conducted to evaluate pair-wise differences among the three groups, controlling for Type I error across tests by using the Mann-Whitney *U* Test Bonferroni approach. The results of these tests indicated significant differences among all three groups. However, the difference between Groups 2 and 3 is in a different direction than was hypothesized (M = 4.33 for Group 2, M = 4.19 for Group 3), indicating decreasing confidence between groups. Therefore, the hypothesis was partially supported.

Regarding research question 5 (Does a TBI educational diagnosis by school psychologists lead to producing a higher number of TBI-related educational accommodations?), a *t* test was utilized. Before conducting this analysis, the data were examined regarding the assumption of normality of distribution. The Shapiro-Wilk test was utilized to further examine the distribution of the data. The Shapiro-Wilk test was significant (.91, $p < .01$), indicating the assumption of normality is not satisfied. In light of this fact, a *t* test was conducted for tentative interpretation to evaluate the hypothesis. The test was significant, t (47.17) = - 3.93, $p < .01$. School psychologists who recognized TBI as the educational diagnosis produced more TBI-related accommodations (M = 3.07, SD = 1.80) compared to school psychologists who did not (M = 1.5, SD = 1.44; see Appendix I7.) The 95% confidence intervals for the difference in means ranged from -2.38 to -.77.

In light of the possible problems using parametric tests (*t* test) a non-parametric test procedure was used (Mann-Whitney U Bonferroni) for tentative interpretation, and it was significant (U = 331.50, $p < .01$). Again, the results showed there is a significant difference in the number of TBI-related accommodations produced by the psychologists who selected TBI as the educational diagnosis compared to those who did not. The results supported the research hypothesis.

Table 7 provides a summary of the significant differences found between groups.

Table 7

Significant Group Differences for Each Hypothesis

Hypothesis	Nature of Test	Significant differences as anticipated?		
		Group 1 v 2	Group 1 v 3	Group 2 v 3
TBI diagnosis (Hypothesis one)	Logistic regression	No	Yes	-
	Odds ratio	2.12	5.09	2.40
	Non-parametric	-	-	-
Self-rated confidence in diagnosis (Hypothesis two)	Parametric	No	No	No
	Non-parametric	No	No	No
Number of TBI-related accommodations (Hypothesis three)	Parametric	Yes	Yes	No
	Non-parametric	Yes	Yes	No
Self-rated confidence in accommodations (Hypothesis four)	Parametric	Yes	Yes	No
	Non-parametric	Yes	Yes	No (opposite direction)
		Significant differences as anticipated?		
TBI-related accommodations if TBI diagnosis is made (Hypothesis five)	Parametric	Yes		
	Non-parametric	Yes		

Chapter 5

DISCUSSION

This chapter consists of an interpretation of the study's results for each of its five hypotheses, implications for practice, and limitations of the study.

Regarding the first hypothesis, it was expected that a more comprehensive evaluation would lead a higher rate of TBI diagnosis by school psychologists. This expectation was supported by current findings, as the results of the logistic regression were statistically significant, though the strength of the relationship was not strong. Important differences were found in the rate of TBI selection between those at a Pre-evaluation and Comprehensive level of evaluation. Odds ratios indicate that when school psychologists in this study received comprehensive information that included neuropsychological test scores, they were five times more likely to conclude a TBI diagnosis was the best choice for the student compared to those who received only a Pre-evaluation level of information, and 2.40 times more likely to do so than those given a Basic level of information. This seems to imply that a comprehensive evaluation that includes neuropsychological instruments (e.g., to test memory, executive function, and motor performance) can be helpful to detect some of the deficits that commonly affect students with TBI. Furthermore, it can be argued on logical grounds that such tools help the school team (including consulting physician) fairly judge whether a TBI might be present. Specifically, the IDEIA definition calls for detection of impairments in cognition, language, memory, attention, reasoning, abstract thinking, judgment, problem-solving, sensory, perceptual and motor abilities, psychosocial behavior, physical functions, information processing, and speech. As cognitive, physical, and emotional effects are common consequences of TBI in this age group (e.g., Babikian and Asarnow, 2009), one might question how decisions about impairments in these critical domains occurs without explicit assessment of the domains in question.

An equally interesting finding is that a typical evaluation at the Basic level using psychoeducational instruments (e.g., WISC-IV, Woodcock-Johnson-III) did not make a significant difference in predicting TBI diagnosis compared to a Pre-evaluation (no formal testing) condition. However, the odds ratio of 2.12 times indicates that if school psychologists are left only with scores of psychoeducational instruments, they are still more likely to detect a TBI in a student such as this than if they only reviewed records and teacher attempts to increase motivation. In the aggregate, these facts suggest that when school psychologists encounter a student who might warrant TBI consideration, they should assure that he/she receives a comprehensive evaluation including school-based (ecologically sensitive) data and objective psychometric data regarding cognition, language, memory, attention, reasoning, abstract thinking, judgment, problem-solving, sensory, perceptual and motor abilities, psychosocial behavior, physical functions, information processing, and speech.

It is interesting to note that even with the most comprehensive evaluation information, nearly one-half (44%) of school psychologists still did not select the TBI category. It is possible that participants may have misattributed the student's symptoms to another cause. Diagnostic decisions about TBI are complicated because symptoms expressed by children with TBI are not exclusive to head injury. In a practitioner review of the psychological sequelae of head injury in children and adolescents, Middleton (2001) in the UK discussed the example of inattentive behavior (characteristic of the hypothetical student in this case), which also may be a sign of attention deficit hyperactivity disorder (ADHD), but could also result from brain injury, anxiety, or conduct disorder. Failure to follow instructions (also characteristic of the hypothetical student in this case) could be due to a TBI-related memory deficit or simply a developmental (i.e., nonacquired) memory problem.

Assuming the student's problems are best attributed to TBI, it is interesting to examine the nature of misattribution made in this study. These are seen in Table 6, which was generated when a supplemental (non-hypothesis-related question) was asked. In general, it appears that if a TBI explanation is not invoked, that a number of ad hoc explanations arise. Most of these explanations (e.g., hormones, family troubles) seem to be counterproductive as they would provide the school team no means to recognize that a potentially transient problem that might be lessened by accommodations and understanding was actually the source of the student's problem. Wodrich, Pfieffer and Landau (2008) argued that when health related problems appear at school, understanding that they exist and how they might express at school (e.g., regarding school productivity, attention, attendance, or interpersonal adjustment) is a crucial step in creating effective and compassionate school services.

Regarding the second hypothesis, school psychologist-participants were no more confident across all three levels of evaluation comprehensiveness. In fact, confidence actually fell slightly for participants at the Comprehensive Level (M = 3.76), even though they received neuropsychological test results. Participants' mean confidence overall (3.76) was between 3 and 4 on the Likert-type scale (*"Between confident and unsure*" and "*Somewhat confident*"). It can be argued that school psychologists may be unfamiliar either with TBI or with neuropsychological testing. Support for the first argument comes from CDC data indicating that annually an average of 511,257 TBI's occur among children ages 3-14 years (CDC, 2010), whereas only 15,547 students ages 3-14 years were served in the TBI category nationally in 2010 according to the Data Accountability Center (DAC; Office of Special Education Programs, U.S. Department of Education, 2010). Support for the second argument regarding unfamiliarity with neuropsychological testing comes from a study of school psychology training programs. Walker, Boling, and Cobb (1999) studied the extent to which school psychology training programs prepare their graduates to assist students with TBI. Specifically, they surveyed all U.S. school psychology training programs concerning their training practices in neuropsychology and brain injury. The final sample included 86 training programs in 32 states, of which relatively few programs offered training in neuropsychology and brain injury, and the training in those programs appeared to be limited in nature and content. Fifty percent of the programs responding to the survey required some level of neuropsychological training (a course, a module in a course, or a class within a course) and 15% indicated such training was optional. Although many programs indicated they indeed covered aspects of neuropsychology and brain injuries, only approximately one-quarter reported a full-time program faculty member with some level of neuropsychology expertise. Consequently, Walker, Boling and Cobb contended that training programs in school psychology were failing to fully prepare their graduate students for work with students with brain injury. Similar results were found in a more recent study conducted with North Carolina school psychologists. In this study assessing the perceptions of 304 school psychologists, Hooper (2006) found that nearly 79% of participants reported they had not received any formal training in TBI either via pre-service programs or continuing education.

Regarding the third hypothesis, it was expected that a more comprehensive evaluation would lead school psychologists to create more TBI-related accommodations. This expectation was partially supported. Although providing school psychologists with more comprehensive evaluation data in general boosted TBI accommodations, no such boost was associated with increasing the comprehensiveness from the Basic level to the Comprehensive level. In other words, any evaluation leads to increased accommodations, but there was no added benefit when school psychologists accessed the most comprehensive evaluation information. Again, it may also be the case that school psychologist-participants may be less familiar with neuropsychological testing and so did not derive added benefit from it.

Indeed, while there is a body of research on strategies for children with learning disabilities who have deficits in domains that also characterize children with TBI, no studies were found that investigated how school psychologists accommodate students with a TBI at school, or the effects of varying levels of psychoeducational evaluation on accommodations they use. Practitioner reviews (e.g., Bowen, 2005) suggest strategies for students with TBI based on research involving children with symptoms in the same domains as students with TBI (e.g., memory difficulties in the cognitive domain). A study by Taylor et al. (2003) included frequencies of classroom accommodations, but the accommodations were of limited scope (i.e., alternative testing procedures and modified seating arrangements.) Thus studies are needed to investigate ways in which school psychologists accommodate students with a TBI at school, and the efficacy of specific educational accommodations for TBI. This study begins that investigation by identifying accommodations produced by school psychologists for a hypothetical student with a TBI.

Regarding the fourth hypothesis, the expectation of increased confidence in accommodations from enhanced evaluation comprehensiveness was supported. But as was the case regarding number of accommodations, no enhancement of accommodation-related confidence attended the most comprehensive evaluation level. Again, school psychologists tended to indicate quite favorable levels of confidence in all three groups (M = 3.85, 4.44, and 4.17; 4 = *somewhat confident*, 5 = *very confident).* It is noteworthy that mean confidence was higher at all three levels of evaluation for educational accommodations than it was for educational diagnosis. Interestingly, mean confidence again dropped slightly at the Comprehensive level when rating confidence in accommodations, similar to the drop in confidence at the Comprehensive level for educational diagnosis. Again, it can be argued that school psychologists may be less familiar with neuropsychological testing and so felt less confidence interpreting such test results. As already discussed, no studies were found that investigated how school psychologists accommodate students with TBI at school or their confidence in doing so.

Regarding the fifth hypothesis, it was expected that school psychologist–participants who selected a TBI educational diagnosis would create more TBI-related accommodations than counterparts who did not select TBI. This hypothesis was supported. This suggests that determining a TBI diagnosis (the presumptive choice) is important in enabling school psychologists to provide educational assistance to students with TBI. Conversely, this finding implies that, without a correct educational diagnosis, educational accommodations are less likely to fit the student’s needs. This result may be of interest to schools using response to intervention (RTI) programs where interventions are produced without an educational diagnosis. Results in this study suggest that having a correct educational diagnosis may assist school personnel in creating more accommodations that meet student needs. Again, no studies were found investigating whether school psychologists who know of a correct TBI diagnosis are better able to meet a student’s needs. More study is needed to explore the predictors of providing educational interventions that meet the needs of children with TBI. While studies have been done of the usefulness of RTI, that subject is beyond the scope of this study.

Implications for Practice

This study has several implications for practice. First, regarding proper TBI diagnosis, when scores of neuropsychological testing (e.g., BASC-2, WRAML-2) were given to school psychologists, they were five times more likely to conclude a TBI diagnosis was the best choice compared to when they were given only a Pre-evaluation level of information, and 2.4 times more likely compared to when they were given a Basic level of information. Thus, this suggests that, to determine an educational diagnosis, school psychologists should evaluate the student with a neuropsychological test battery or refer the student out for testing. With regard to accommodations, when neuropsychological scores were given to school psychologists, it boosted accommodations in general, but no boost was found in accommodations by increasing the evaluation from a Basic to a Comprehensive Level. This suggests that when school psychologists encounter a student with a history of a head injury, basic testing (e.g., WISC-2, Woodcock-Johnson) may be useful in producing accommodations. Additional neuropsychological testing may not be helpful.

Findings with regard to diagnosis are at least partially supportive of a position adopted 14 years ago by Ewing-Cobbs, Fletcher, Levin, Iovino and Minor (1998) that, in addition to traditional assessments (intelligence and achievement tests), neuropyschological evaluations should also be used to comprehensively assess the full impact of a head injury on a child's functioning.

It is possible that additional research might help to more fully determine whether more comprehensive evaluations that include neuropsychological testing, are significantly more likely to assist in determining a correct educational diagnosis and to lead to more educational accommodations that match the needs of a student.

A second implication of this study is that school psychologists should be aware of misattribution of the educational problems of students with TBI to some other cause. In this study, it was found that school psychologists misattributed TBI to explanations such as ADHD and difficulty adjusting to middle school; see Table 6. In studies of teachers with hypothetical students (i.e., with diabetes or with epilepsy) teachers assigned health-related problems to such factors as emotional problems, anxiety, and depression (Wodrich, 2005). A similar issue of misattribution may exist for school psychologists, who may take actions based on misconceptions regarding other problems. In order to avoid misattribution, school psychologists should consider all possible causes of a student's symptoms, and whether neuropsychological testing might be helpful in avoiding misattribution.

Finally, these results imply a need for future research addressing the role of school psychologist training regarding TBI. The total number of participants in this study making an educational diagnosis of TBI was only 28 (36.8%). Slightly more than half (56%) of those receiving the most Comprehensive level of information made a TBI educational diagnosis. Confidence ratings in the group that received neuropsychological test results were modestly lower than those who received basic test results (i.e., WISC-IV, Woodcock-Johnson-III), suggesting possible lack of confidence in interpreting neuropsychological data and potential need for training in that area as well. Findings also indicate the importance of having a TBI educational diagnosis as it leads to producing more accommodations that meet TBI-related needs. Therefore, it may be helpful for school psychology training programs to incorporate additional training for school psychologists on students with head injuries, including training in educational accommodations to assist such students, and neuropsychological training to assist in identifying those with a TBI educational diagnosis.

Limitations

The findings of this study must be interpreted with caution due to several limitations. The first limitation is the analog format of this study. An analog format was used due to the difficulty of using randomized procedures to compare the effects of varying levels of psychoeducational evaluation in a real life situation. As participants in this study read about the symptoms of a hypothetical student, their educational diagnosis and confidence are not based on a real situation. Consequently, that may have made it more difficult to detect actual differences across groups. Further, in a real-life situation, school personnel can gather more information about changes in a child's functioning from others such as the child's physician, parent, or teachers, which could affect outcome.

Second, only school psychologists in three school districts in the Phoenix area were sampled. As the educational programs and requirements for school psychologists regarding formal training in neuropsychology and TBI vary across states, this limitation could have meaningful implications. Therefore, results may not be generalizable to the population of school psychologists outside the Phoenix metropolitan area.

Third, while random assignment was used in the distribution of the surveys in this study, it is possible that group differences in the frequencies on one or more of the demographic variables could have influenced outcomes. For example, the youngest school psychologists were a higher percentage of those in Groups 1 and 2 than in Group 3. There was also a higher percentage of participants with a PhD in Group 1 than in Groups 2 and 3. It is unknown what if any influence these demographic differences might have had in the results. It is also possible that school psychologists with more experience in working with a student with a head injury might demonstrate more confidence in their educational diagnosis or in suggesting accommodations than would a school psychologist without such experience. Further, school psychologists who obtain a PhD or PsyD may have more training in TBI or assessment, and therefore may have more confidence in their decisions than those with less training. While this study asked demographic questions regarding the educational degree participants had received (e.g., Masters, PhD), questions were not asked regarding specific training in TBI, as it could have influenced the educational diagnosis. It was not within the scope of this study to differentiate results based on demographic factors. A substantially larger study would likely be needed to have sufficient power to make such determinations. Future research might further differentiate school psychologists by education, years of experience, amount of experience working with students with TBI, or by training they received in TBI.

Finally, power analyses indicated that power was sufficient for this study (P = .80) assuming a correlation value of a large effect size (r = .05). The alpha level (.05) used in this study could make it more likely that the significant differences that appear to exist in the means between participants who received information at different levels don't actually exist, leading to a Type 1 error (rejection of a true null hypothesis). However, use of a lower alpha level would make it more difficult to detect differences, and could instead lead to a Type II error (acceptance of a false null hypothesis.)

Future Research

There are many possible directions for further research concerning the evaluation, diagnosis, and accommodation of students with head injuries. For example, researchers such as Taylor et al. (2003) have commented on the critical need for research on the effectiveness of educational interventions. No empirical studies were found that investigated the efficacy of specific educational accommodations for TBI at school. Given the current thrust toward evidence-based interventions, the effectiveness of accommodations for students with TBI should be assessed.

Second, this study recruited local participants. Further research is needed with larger and more diverse samples of school psychologists in other geographical areas.

Third, this was an analogue study, which could have affected the outcomes. Further research is needed on the evaluation, educational diagnosis, and educational assistance provided to actual students who have incurred a TBI.

Fourth, future research could be helpful to examine the effects of special education placement on children with TBI, such as comparing students with TBI who are placed or not placed in special education settings.

Finally, research is needed to determine whether more school psychology experience or more extensive training influence TBI educational diagnosis, effective planning (e.g., generation of accommodations) or school psychologist's confidence when confronted with the prospect of a student with TBI.

Conclusion

Students with traumatic brain injuries (TBI) sometimes experience impairments that can adversely affect their educational performance. TBI in children is an important subject, particularly educational assistance provided to them. Despite its limitations, this study provides helpful information regarding the effects of increasingly comprehensive levels of psychoeducational evaluation on educational diagnosis and accommodation of students with head injuries. Though analog methodology was used, this study provides a starting point for future research comparing psychoeducational evaluation of students with head injuries by school psychologists. The results of this study suggest the importance of recognizing a TBI educational diagnosis, as it is more likely to lead to educational accommodations that meet TBI-related needs. Results also suggest that a comprehensive evaluation that includes neuropsychological instruments can be helpful to detect some of the deficits that commonly affect students with TBI. Finally, the results of this study suggest the importance of training school psychologists in TBI and in the interpretation of neuropsychology test results to increase confidence in their use.

Understanding how school psychologists diagnose and accommodate students with head injuries may help guide schools in the assessment and accommodation of students, and may help shape school psychology training programs. It is hoped that information gleaned from the present study is used to help children who may have a TBI by highlighting the need for a psychoeducational evaluation that includes psychometric testing, an accurate educational diagnosis, and accommodations that meet their needs.

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APPENDIX A

LETTER TO PARTICIPANTS

Dear Participant:

I am a graduate student in the school psychology program at Arizona State University. I am conducting a research project on how school psychologists diagnose and assist students with learning problems at school. I would greatly appreciate your willingness to participate in that study. Participation would take about 20 minutes. It involves reading some information about a hypothetical student who is experiencing problems at school, then completing a related survey. Your participation is voluntary. You can choose not to participate, or to withdraw from participation at any time. Return of the survey will be considered your consent to participate. You will not be asked to place your name on the survey. Your responses will be anonymous.

As a thank you for participating, you may choose to place your name in a $50 gift raffle available to school psychologists in your district. Raffle forms may be returned along with the completed surveys. Raffle forms will be kept separate from completed surveys, and will only be used to determine the winner of the raffle, then destroyed. The results of the research may be published, but you will not be named. Your name will remain unknown.

You should participate in the study only if you are a certified school psychologist. If you should receive more than one request to participate, please do not do so more than one time.

Please contact me if you have any questions about this study. I can be reached at 520-444-7845. Or, you may also contact my advisor, Dr. David Wodrich, at 480-965-7117. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of Human Subjects Institutional Review Board through the ASU Office of Research Integrity and Assurance at 480-965-6788. Thank you again for your time and participation. I very much appreciate it.

Lisa J. Hildreth, M.A.

RAFFLE FORM

PARTICIPANT NAME:

____

Thank you again for participating in this study.

APPENDIX B

DIRECTIONS

Please read the following description of John, a middle school student, and complete the survey that follows. Please respond to the survey as if you are the school psychologist working with a team at the school John attends.

APPENDIX C

DESCRIPTION OF HYPOTHETICAL STUDENT

Information contained in John's cumulative folder:

Academic history: John is 12 years old and in the 7th grade in your school district. John's family moved to the district during his 6th grade year. Last year, John missed 4 days of school and had average grades. He passed the vision and hearing tests, and has not received any special education services. His file suggests he is sociable and likes sports. John's cumulative folder suggests he is not doing well academically this year, though his performance fluctuates. This includes poor performance on content area tests, including math tests. Attempts to increase motivation by using privileges and rewards have been unsuccessful. He has been absent more often than last year.

Health history: John appears to be generally healthy based on annual exams by his pediatrician from birth to age ten. During those exams, the pediatrician found him to be free of attention and learning problems. John has had normal childhood illnesses and has been hospitalized twice. The first hospitalization was at age 5 for dehydration from a seasonal flu. The second one was 8 weeks ago when he was examined in an emergency room after a bicycle accident, and was admitted for 2 days of monitoring by a neurosurgeon. He was subsequently released and permitted to return to school after a week of rest.

Family history: John is the youngest of 3 children, all of whom live with a single mother.

The school psychologist and the team decided to complete a psychoeducational evaluation

Information from teachers:

John’s changing behavior this year has puzzled his teachers. For example, he now appears to be frequently inattentive in class and less likely to concentrate on schoolwork. Furthermore, he now forgets or loses his homework, fails to follow instructions, completes assignments slowly, and sometimes stares out the window instead of working. When he does complete classwork, he may read slowly.

John's teachers also believe that he gives up easily, sometimes blaming a headache or an upset stomach. They have further noted irritability, anger, or defiance. Also noted this year, he falls asleep in class and sometimes leaves the room in the middle of music class. His teachers now note occasional aggression toward classmates and fewer friends.

Information from school nurse:

The school nurse reports occasional visits complaining of headaches, tiredness, and/or upset stomach. However, on these occasions he has never had a fever.

Information from parent:

John's mother provided a description of an active boy who historically enjoyed horseplay with his brothers and riding his bike with friends in the neighborhood. More recently, he has been more uncooperative and difficult to control at home. For instance, he now has temper outbursts, and increased difficulty getting along with siblings.

Testing Observations:

John was tested during a single morning. He was cooperative and rapport was easily established. John struggled to maintain attention to tasks and had difficulty following directions. Likewise, he was distractible and often made statements that it was difficult for him to remember. He could be re-directed back to tasks, but would become frustrated when the material became difficult.

Test scores:

Wechsler Intelligence Scale for Children – Fourth Edition:

Index	Scale Score	95% Confidence Interval	Percentile	Description
Verbal Comprehension Index	98	91- 105	45	Average
Perceptual Reasoning Index	104	96-111	61	Average
Processing Speed Index	83	77-92	13	Low Average
Working Memory	75	69-87	5	Borderline
Full Scale	90	85-95	25	Average

Woodcock-Johnson-III Tests of Achievement:

WJ-III	Standard Score	Percentile	Description
Letter-Word Identification	98	45	Average
Reading Fluency	87	19	Low Average
Calculation	103	58	Average
Math Fluency	82	12	Low Average
Spelling	94	34	Average
Writing Fluency	84	14	Low Average
Passage Comprehension	100	50	Average
Applied Problems	94	34	Average
Word Attack	106	66	Average

The team concluded that more comprehensive data was needed. Therefore, the following tests were also administered.

Teacher Rating Scale – BASC-2:

BEHAVIOR ASSESSMENT SYSTEM FOR CHILDREN: (Teacher Report)

	T Score	Score Range
Hyperactivity	58	Average
Aggression	52	Average
Conduct Problems	66	At-Risk
Anxiety	70	Significant

Depression	72	Significant
Somatization	84	Significant
Attention Problems	72	Significant
Learning Problems	68	At-Risk
Atypicality	58	Average
Withdrawal	64	At-Risk
Adaptability	38	At-Risk
Social Skills	47	Average
Leadership	42	Average

Parent Rating Scale – BASC-2:

BEHAVIOR ASSESSMENT SYSTEM FOR CHILDREN: (Parent Report)

	T Score	Score Range
Hyperactivity	50	Average
Aggression	49	Average
Conduct Problems	59	Average
Anxiety	62	At-Risk
Depression	74	Significant
Somatization	61	At-Risk
Atypicality	55	Average
Withdrawal	72	Significant
Attention Problems	78	Significant
Adaptability	33	At-Risk

Social Skills	48	Average
Leadership	45	Average
Activities of Daily Living	50	Average
Functional Communication	46	Average

All of the validity indexes fell in the average range on both the teacher and the parent

BASC-2.

Wide Range Assessment of Memory and Learning (WRAML-2):

Subtest	Description of subtest	Scale Score	Qualitative
Picture Memory	Visual declarative memory	9	Average
Design Memory	Visual declarative memory	12	Average
Verbal Learning	Verbal declarative memory	6	Borderline
Story Memory	Verbal declarative memory	6	Borderline
Verbal Learning Recall	Delayed verbal memory	5	Borderline
Story Memory Recall	Delayed verbal memory	4	Extremely Low

I=10; Sd=3

Grooved Pegboard Motor Exam: The grooved pegboard motor exam measures fine motor speed and dexterity.

Hand	Seconds	Mean	SD	Drops	Score
Dominant	84	70	10	2	Below Average Range
Non-dominant	85	76	10	0	Below Average Range

Trail Making Test: Measures executive functioning, speed and maintenance of response set.

	Errors	Mean	SD	Qualitative	Time
Part A	0	16.4	5.6	Average	15
Part B	3	43.3	20	Below Average	72

Rey-Osterrieth Complex Figure:

Condition	Description of task	Raw Score	Standard Score	Percentile	Qualitative
Copy	Capacity to organize visual material via drawing	24	--	<1	Low
Delayed Recall	Organization and retention of visual memory via drawing	12.5	33	4	Low

Controlled Oral Word Association (FAS):

Condition	Description of task	Total	Mean	SD	Qualitative
FAS	Measures verbal fluency	18	28.2	8.1	Low Average
Animals	Measures verbal fluency	6	15.5	3.8	Borderline

APPENDIX D

SURVEY

After reading about John, please complete the following questions:

1. Given the information provided, please judge whether John is likely to satisfy the definition of a student with a disability under the Individuals with Disabilities Improvement Act (IDEIA). If you judge that he has an educational diagnosis of a disability, please circle the primary disability category below. If you believe John has no disability, please circle item (n) – none.

a. Mental retardation
b. Hearing impaired
c. Deafness
d. Speech or language impairment
e. Visual impairment, including blindness
f. Emotional disturbance
g. Orthopedic impairment
h. Autism
i. Traumatic brain injury
j. Other health impairment
k. Specific learning disability
l. Deaf-blindness
m. Multiple disabilities
n. None

2. How confident are you in the selection you made above? Please rate your confidence that the category you selected is correct by circling the item:

(5) Very confident about my selection
(4) Somewhat confident about my selection
(3) Between confident and unsure about my selection
(2) Somewhat unsure about my selection
(1) Very unsure about my selection

3. If you checked (n) “none” in question one above, do you have an explanation for John’s presentation?

4. Educational accommodations are defined as “an adjustment designed to assist a student in overcoming classroom and learning problems that can be applied in a regular education setting without the use of special education services or funding.” In Table 2 below, please list any educational accommodations that you believe would be effective to address John’s educational needs. For each accommodation listed, please provide a specific rationale. See the case of Maria below for helpful examples. In Table 2, please also rate your confidence in the accommodations you listed (how confident you are that they will be effective to meet John’s educational needs), as follows:

(5) Very confident
(4) Somewhat confident
(3) Between confident and unsure
(2) Somewhat unsure
(1) Very unsure

Table 1

Example of Educational Accommodations for Maria

Brief description of accommodation	Specific rationale for accommodation	Confidence (1-5) in effectiveness of accommodation
Helper to push chair	Lack of strength	5
Deliver diploma off stage	Difficulty with wheelchair	2
Ramp	Difficulty with mobility	4

Note: Maria is unable to walk and must use a wheelchair. She needs to go on stage for graduation.

Table 2

Educational Accommodations for John

Briefly describe accommodation	Provide a specific rationale for this accommodation	Rate your confidence (1-5) in this accommodation

5. Please provide the following demographic information:

(a) Circle the number of years you have worked as a school psychologist:

0-5
6-10
11-15
16-20
21-25
More than 25

(b) Circle all settings in which you are currently working:

Preschool
Elementary school
Middle school
High school
Not working in a school (describe setting):

(c) Circle the highest degree you have attained:

Bachelor
Masters
Specialist
PhD
Ed D

Psy D

(d) Circle your age range:

Under 25
25-34
35-44
45-54
55 and over

(e) Circle your gender:

Male
Female

APPENDIX E

VERBAL RECRUITMENT

Hello. My name is Lisa Hildreth. I am a graduate student at Arizona State University. I am conducting a research project on how school psychologists diagnose and assist students with learning problems at school. I am here today to request your participation in that study. I would greatly appreciate your willingness to do so.

Your participation would take about 20 minutes. It would involve reading some information about a hypothetical student who is experiencing problems at school, and then completing a related survey. Survey responses will be anonymous.

As a thank you for participating, you may put your name in a $50 gift raffle. There will be a letter on top of the materials that will tell you more about how to do that.

I will put the surveys and instructions on a table for those who would be willing to take one to complete. There will be two boxes available for the completed surveys and raffle forms, which will be kept separate.

Again, I would very much appreciate your time and participation. Thank you very much.

APPENDIX F

INSTITUTIONAL REVIEW BOARD APPROVAL - ARIZONA STATE UNIVERSITY

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	David Wodrich EDB
From:	Mark Roosa, Chair Soc Beh IRB
Date:	04/20/2011
Committee Action:	**Exemption Granted**
IRB Action Date:	04/20/2011
IRB Protocol #:	1103006247
Study Title:	Do More Comprehensive Psychoeducational Evaluations Promote TBI Educational Diagnosis?

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.

APPENDIX G

APPROVAL SCOTTSDALE SCHOOL DISTRICT

Scottsdale *Unified* School District

Arizona's Most Excelling Schools!

Education Center
3811 North 44th Street
Phoenix, Arizona 85018-5420

Telephone: (480) 484-6278
FAX: (480) 484-6292
Web site: www.susd.org

July18, 2011

Lisa Hildreth
4215 N. Drinkwater Blvd. Apt. #243
Scottsdale, Arizona 85251

Re: Research Proposal

Dear Ms. Hildreth:

This will confirm approval of your research study, "Do more comprehensive psychoeducational evaluations promote TBI educational diagnosis?" A copy of the signed approval form is enclosed.

Please provide us with the results of this research when they are available.

Sincerely,

Dr. David McNeil
Director of Assessment, Accountability & Research

APPENDIX H

APPROVAL TEMPE ELEMENTARY SCHOOL DISTRICT

REQUEST TO CONDUCT RESEARCH IN TEMPE SCHOOL DISTRICT NO. 3

Send research request to:

Chris Busch
Superintendent
Tempe School District #3
3205 South Rural Road
Tempe, Arizona 85282

I wish to conduct a research project in Tempe School District #3 and request approval of the Research Committee to contact the appropriate personnel.

Lisa Hildreth	11-9-11
Name	*Date*
School Psychologist Graduate Student, Researcher	520-444-7845
Position	*Phone*

Return Address: 4215 N. Drinkwater Blvd. #243, Scottsdale, AZ 85251

Research Project is for:

____ ASU Class ____ MA Thesis _X_ Doctoral Dissertation
____ Faculty Research ____ University Research ____ Other

Title and Purpose: Title: **Do more comprehensive psychoeducational evaluations promote TBI educational diagnosis?**

Purpose: **The Individuals with Disabilities Education Act (IDEA, 2004) mandates special education services for children with 13 disabilities, including traumatic brain injury (TBI), if impairments listed in the law are persistent and adversely affect educational performance. The data, however, show that relatively few students with head injuries are identified under the TBI label (DAC, 2007). Therefore, the IDEA category designed to ensure specialized services for students with TBI may be underutilized. Furthermore, appropriate accommodations may not be routinely provided. This study investigates the ability of school psychologist to recognize that a student qualifies for a TBI educational diagnosis and to choose TBI-related accommodations to meet the needs of such a student. Information gathered from this study may be used to develop more effective educational services for children with head injuries.**

Approximate number and grade levels of pupils to be involved.

School psychologists will be the only subjects. No students or teachers are involved in the study.

Approximate class time required per pupil: **No class time is needed. School psychologists are the only subjects of the research.**

Name of school(s) and what facilities will be needed: **Researcher would like to attend a regularly scheduled meeting of District school psychologists to make a short request for their participation in the study. About 20 minutes of time by school psychologists would be needed on a one-time basis to review information about a hypothetical student, then respond to a survey questionnaire as if he/she were a school psychologist making a decision on the student's eligibility for services according to the Individuals with Disabilities Education Act (IDEA). A 50$ raffle will be held as a thank you to the school psychologists in the district as a thank you for participation.**

Deadline for completion: **Study completion date is Spring 2012; completion of participation by subjects is requested as soon as possible.**

Comments: **Students who have sustained a TBI may return to school with physical, cognitive, and behavioral impairments that can affect their academic performance or disrupt their learning. Little research to date concerns how often TBI is recognized by school psychologists and how they accommodate such students. This study is a part of a University required Dissertation for a Doctoral Degree. It is hoped that this study will contribute to scientific knowledge concerning the identification and accommodation of students with traumatic brain injury (TBI). I would greatly appreciate the District's assistance. Thank you.**

Date 11/15/11 ***Approved*** ✓ ***Disapproved***______

Signature: Chris Busch ***Comments:***

Chris Busch
Superintendent

Approval indicated on this form is intended to grant to the researcher the opportunity to contact the appropriate personnel to gain their approval and support of this project.

APPENDIX I

FIGURES

Figure I1

Histogram of ratings of confidence in educational diagnosis.

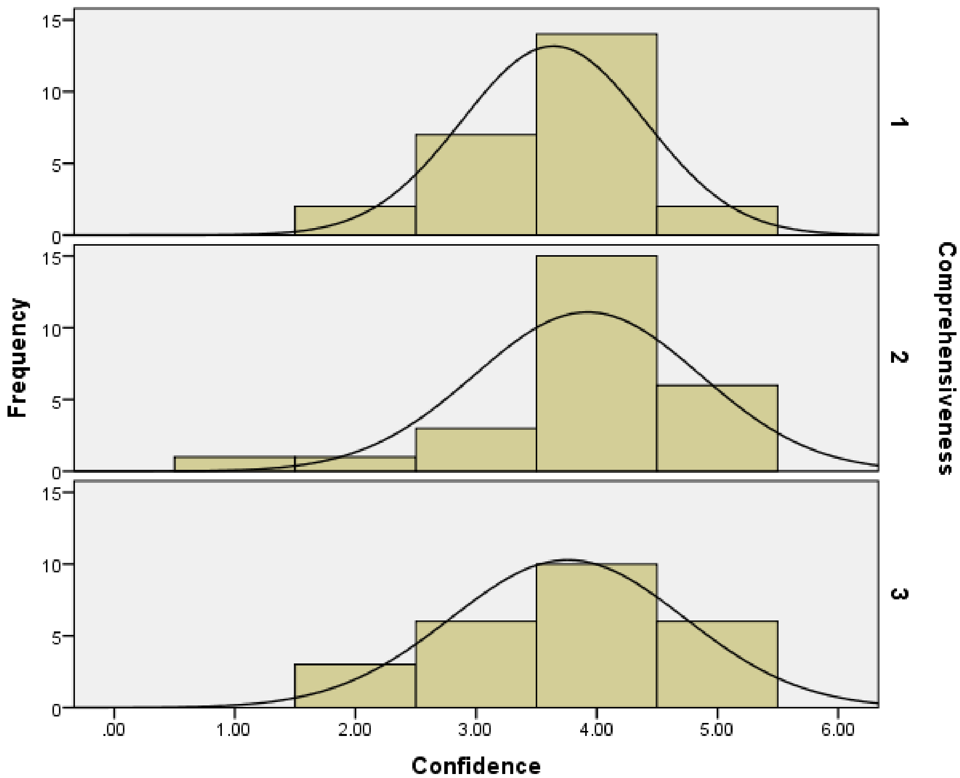

Figure I2

Mean ratings of confidence in educational diagnosis across three levels of comprehensiveness of psychoeducational evaluation.

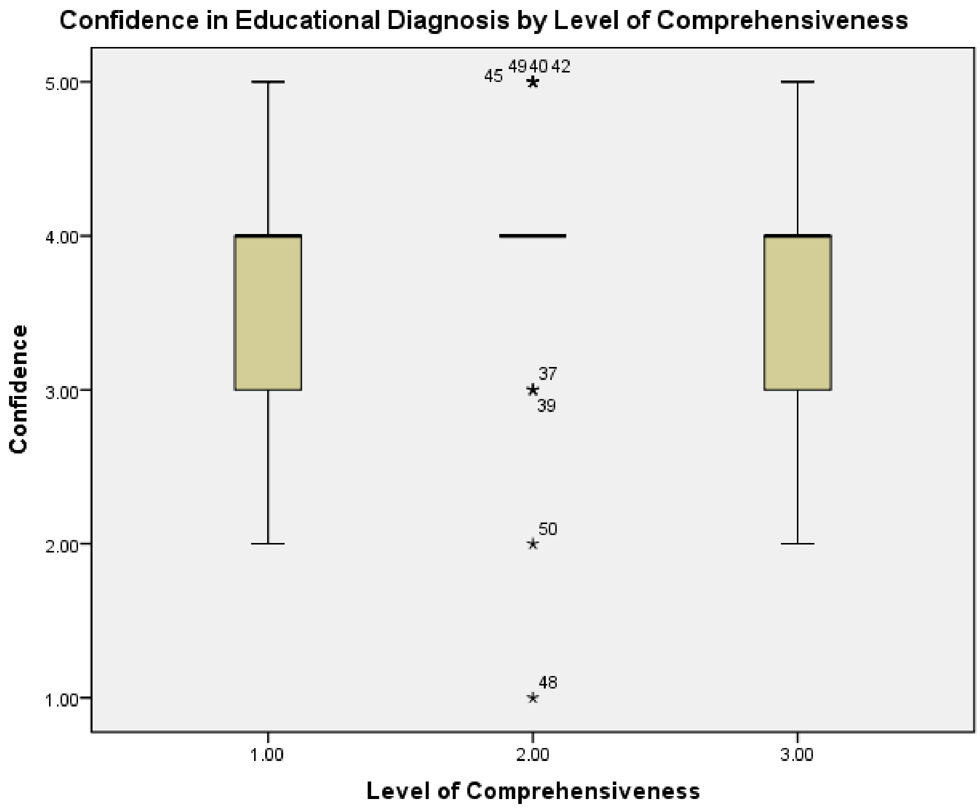

Figure I3

Histogram of number of TBI-related accommodations.

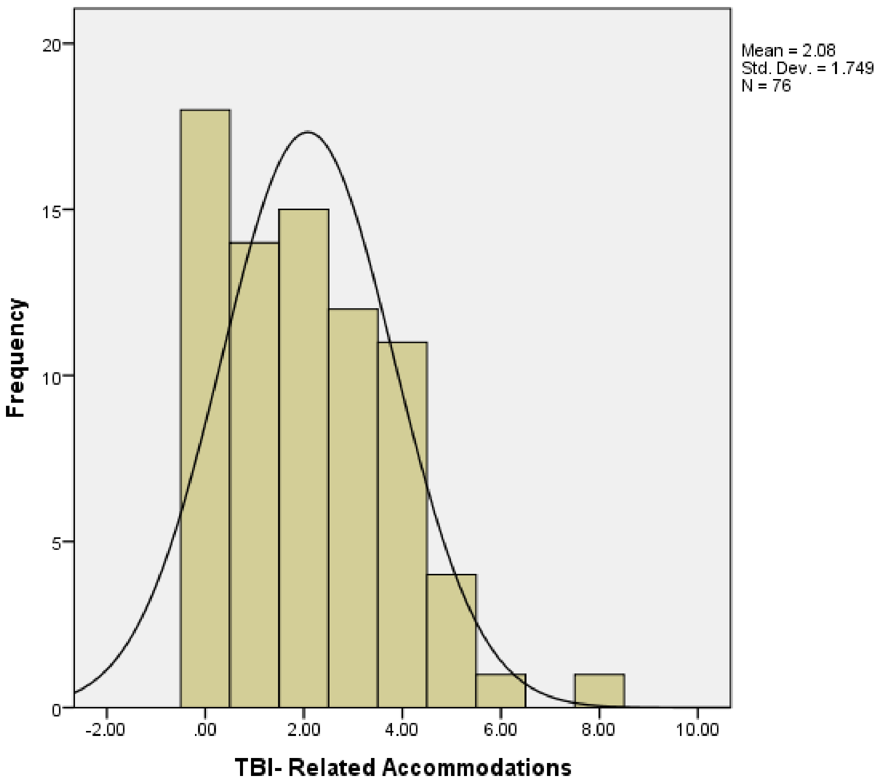

Figure I4

Mean number of TBI-related accommodations across three levels of psychoeducational evaluation.

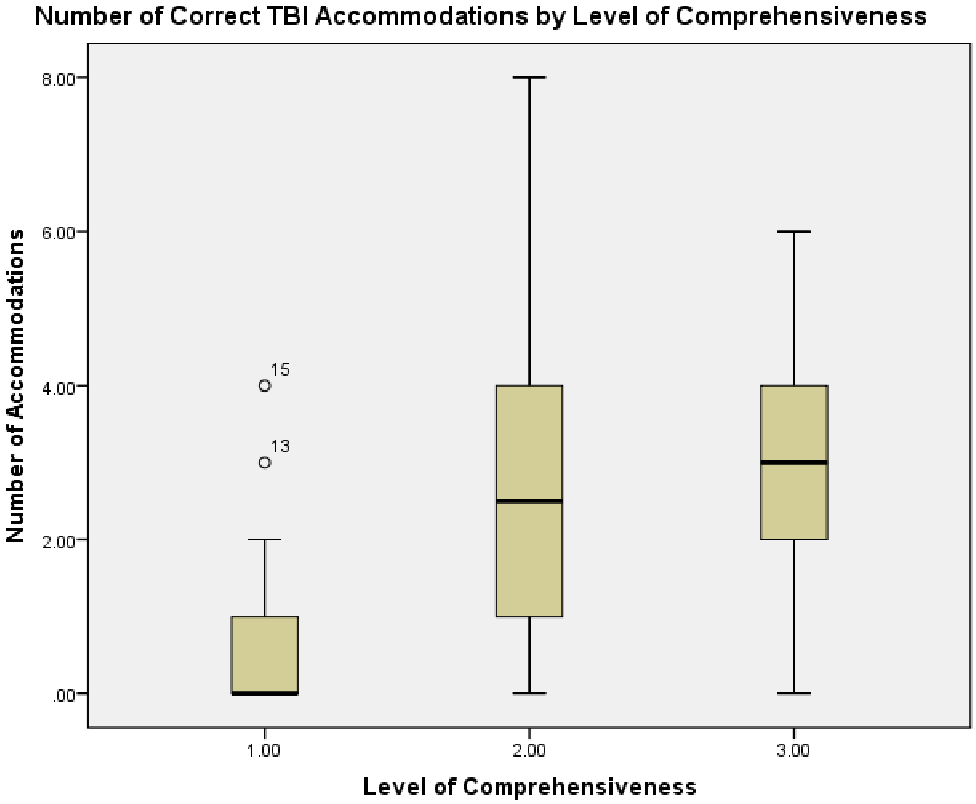

Figure I5

Histogram of confidence in educational accommodations.

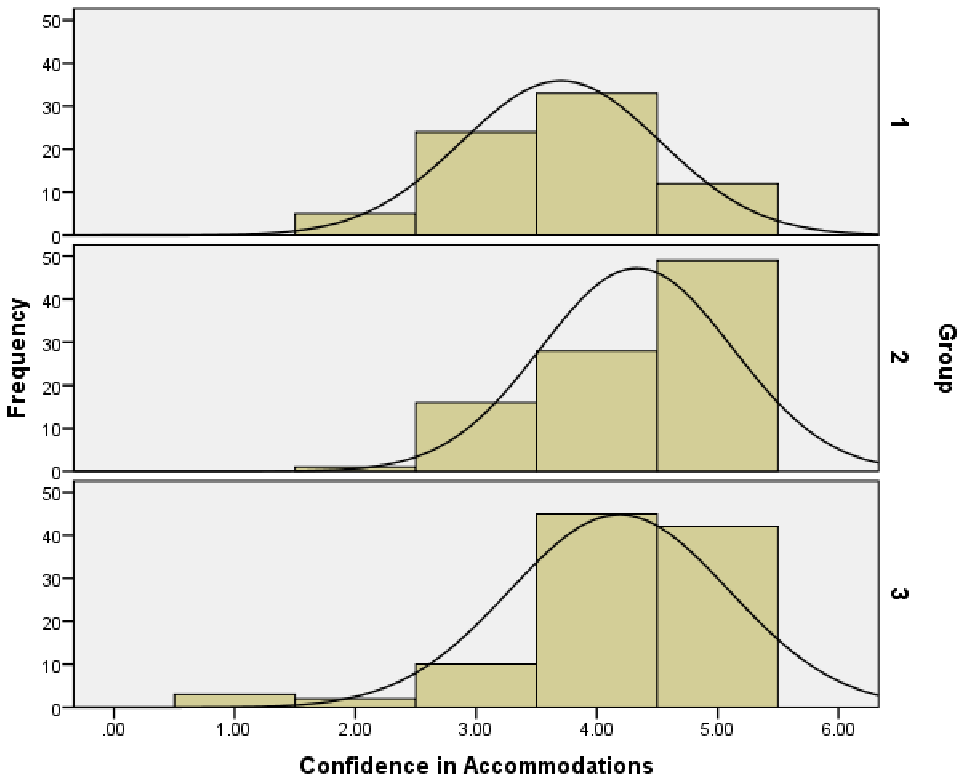

Figure I6

Mean ratings of confidence in educational accommodations across levels of comprehensiveness of psychoeducational evaluation.

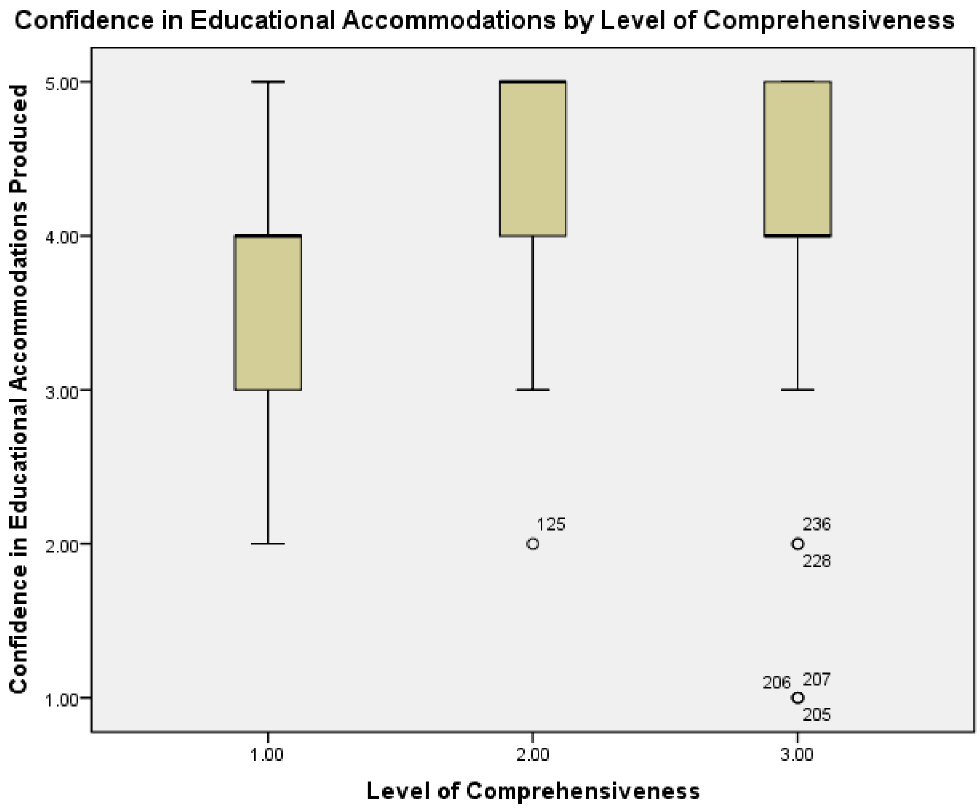

Figure I7

Mean number of TBI-related accommodations produced by school psychologists who chose TBI or non-TBI educational diagnosis.