

PEER DIFFICULTIES IN CHILDREN WITH EPILEPSY: ASSOCIATION WITH  
MEDICAL, NEUROPSYCHOLOGICAL, ACADEMIC, AND BEHAVIORAL  
FACTORS

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In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy

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by  
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The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled

PEER DIFFICULTIES IN CHILDREN WITH EPILEPSY: ASSOCIATION WITH  
MEDICAL, NEUROPSYCHOLOGICAL, ACADEMIC, AND BEHAVIORAL  
FACTORS

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A candidate for the degree of Doctor of Philosophy

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I would like to thank my parents and siblings, John Harlan, Nancy Urtado, John Harlan II, and Nicole Harlan, for setting a strong precedent of obtaining an education and for encouraging my pursuit of a doctoral degree. Most of all, I would like to thank my husband of six years, Scott Drewel, for his steadfast support and unconditional love.

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ABSTRACT

Epilepsy is the most common neurological disorder among children and adolescents. Research indicates that children with epilepsy are at risk for long-term social and psychological problems compared to healthy children or children with other health conditions. This may be due partly to peer difficulties. Peer relationships are important for children's immediate and lifelong social and emotional-well-being. The pediatric epilepsy literature has established that children with epilepsy have more peer difficulties than do healthy children or children with other health conditions (i.e., asthma and diabetes). However, few studies have investigated which variables relate to peer problems in children with epilepsy. Moreover, the pediatric epilepsy literature has not utilized a developmental psychopathological approach to guide the examination of peer difficulties in affected children.

The current study used a developmental psychopathology framework to examine variables associated with peer problems in children with epilepsy, focusing on variables shown to be related to peer difficulties in both typically developing children and children with epilepsy. Variables shown to be directly associated with peer difficulties such as inattentive behavior, anxious behavior, and academic achievement were investigated. Epilepsy-related variables, such as neuropsychological functioning and seizure

characteristics (i.e., age at epilepsy onset, seizure status), were also incorporated into the framework. Data for the current study were obtained from 173 children with epilepsy, ages 8-15. Structural equation modeling was used to determine which variables predicted peer problems in children with epilepsy as well as to test the variables' hypothesized interrelations with one another. With the exception of correlations of seizure status to age at epilepsy onset, neuropsychological functioning, and academic achievement, all variables in the model were related to one another. Anxious behavior mediated the relations between neuropsychological functioning and peer difficulties and seizure status and peer difficulties. Inattentive behavior also mediated the association between neuropsychological functioning and peer difficulties. Moreover, neuropsychological functioning mediated the relation between age at epilepsy onset and each of the proximal variables (i.e., inattentive behavior, anxious behavior, and academic achievement). Examination of model invariance between boys and girls did not reveal any differences in factor indicator loadings, structural means, or structural paths across the two groups. Results imply that, like typically developing children, inattentive and anxious behaviors are related to peer difficulties in children with epilepsy. However, given that neuropsychological functioning and seizure status are directly associated with behavior problems, these may be important to include in the assessment and intervention process for children with epilepsy who are experiencing peer problems. Implications for future research and intervention are discussed.

## Peer Difficulties in Children with Epilepsy: Association with Medical, Neuropsychological, Academic, and Behavioral Factors

Epilepsy is the most common neurological disorder to affect children and adolescents. According to recent estimates, 7 out of every 1,000 children and adolescents have epilepsy, and roughly 45,000 children under age 15 develop the disorder each year (Epilepsy Foundation, 2005; Williams & Sharp, 2000). Epilepsy is defined as having multiple, unprovoked, non-febrile seizures (e.g., staring, loss of consciousness, odd behaviors, convulsions), which are sudden, excessive discharges of electrical energy in the brain (Epilepsy Foundation, 2005; Thompson & Trimble, 1996).<sup>1</sup>

Prior research indicates that children with epilepsy are at risk for long-term social, psychological, academic, and occupational problems compared to the general population (Jalava, Sillanpaa, Camfield, & Camfield, 1997; Kokkonen, Kokkonen, Saukkonen, & Pennanen, 1997) or children with other health conditions (i.e., juvenile rheumatoid arthritis; Wirrell et al., 1997). These findings are present even after controlling for other potential confounding variables such as sex, age, area of residence, and age at illness onset. Several variables may heighten the risk for long-term adjustment problems in children with epilepsy. For example, the disruptive nature of their condition may directly hinder the ability for children with epilepsy to learn necessary life skills (Jalava et al., 1997) or may indirectly affect their adjustment by provoking family distress (Rodenburg, Meijer, Deković, & Aldenkamp, 2005). Nonetheless, one factor that may be of particular importance is peer relationship difficulties. Peer relationships are important for shaping children's social development and influencing their psychological well-being (Bierman, 2004; Hartup, 1983). Moreover, research shows that children who experience

considerable peer difficulties, such as low peer acceptance, are at risk for later problems such as dropping out of school and psychopathology (Parker & Asher, 1987).

Over the years, childhood epilepsy researchers have speculated that the unpredictable and unusual nature of seizures potentially increases the likelihood that affected children will be viewed negatively by their peers, thereby heightening their risk for peer relationship difficulties relative to other children (Kim, 1991; Williams, 2004). In fact, findings from a small body of empirical literature indicate that, after controlling for potential confounds such as age, sex, and socio-economic status, children with epilepsy are less popular and socially accepted (Hodes, Garralda, Rose, & Schwartz, 1999; Matthews, Barabas, & Ferrari, 1982), have lower social competence (Austin, Smith, Risinger, & McNelis, 1994; Caplan et al., 2005; Schoenfeld et al., 1999), greater social problems (Schoenfeld et al., 1999), are more socially isolated (Long & Moore, 1979; Stores, 1978), and have more peer difficulties in general (Davies, Heyman, & Goodman, 2003; Ferrari, Matthews, & Barabas, 1983; Sillanpaa, 1992), than do healthy children (Caplan et al., 2005; Davies et al., 2003; Ferrari et al., 1983; Hodes et al., 1999; Long & Moore, 1979; Matthews et al., 1982; Schoenfeld et al., 1999; Sillanpaa, 1992; Stores, 1978) or children with non-central nervous system (CNS) health conditions (i.e., asthma or diabetes; Austin et al., 1994; Davies et al., 2003; Ferrari et al., 1983; Matthews et al., 1982). Results from several of these individual studies were summarized in a recent meta-analysis that examined the psychological adjustment of children with epilepsy (Rodenburg, Jan Stams, Meijer, Aldenkamp, & Deković, 2005). Rodenburg and colleagues concluded that, compared to healthy children or children with other chronic health conditions, social problems were considerably greater in children with epilepsy.

Moreover, the differences between children with epilepsy and healthy or normative samples yielded large to medium effect sizes, whereas the differences between children with epilepsy and children with other chronic health conditions resulted in small to medium effect sizes. Taken together, the current literature suggests that children with epilepsy are at greater risk for peer difficulties relative to other children. However, at this point little is known about which variables are related to their peer problems.

Considering the impact that peer relationships have on children's social and emotional development (e.g., Hartup, 1983), it is important to identify variables that are related to peer problems in children with epilepsy so that mental health professionals can effectively treat those children with the disorder who are experiencing difficulties with their peers. One preferred way to accomplish this is to adopt a developmental psychopathology perspective, which stresses the importance of understanding child behavioral adjustment difficulties in the context of the continuum of typical child experiences (Rutter & Sroufe, 2000). Extending this framework to understanding the role of health conditions on child adjustment, this study used theory and research on typically developing children as a foundation upon which to examine a model of peer difficulties in children with epilepsy. This study addressed the question of whether a model formulated from research on typically developing children adequately explains why children with epilepsy experience peer difficulties or if variables relevant to having epilepsy (e.g., seizure characteristics, neuropsychological functioning) must also be incorporated into the model. Addressing this important question may provide mental health professionals with an initial understanding regarding whether treatment interventions for peer problems in children with epilepsy should incorporate epilepsy-

related issues or if standard treatment interventions designed for use with typically developing children would suffice. To date, only one research study has examined variables related to peer problems in children with epilepsy. Caplan et al. (2005) revealed that externalizing behavior problems (i.e., oppositional, aggressive, inattentive behaviors) and lower IQ predicted lower social competence in affected children. Although the results of the Caplan et al. study are informative, like many empirical examinations of pediatric epilepsy, the authors did not adopt a theoretical approach to guide their investigation.

Provided this, the purpose of the present study is to investigate if select variables from a theoretical framework and variables related to epilepsy are associated with peer difficulties in children with the disorder. Components of a theoretical model outlined by Coie (1990) will be used to examine potential correlates of peer problems in children with epilepsy because it has proved to be quite useful in organizing information about variables related to peer difficulties in typically developing children (e.g., Sandstrom & Coie, 1999). Variables in Coie's model, such as social behavior problems and academic difficulties, as well as epilepsy-related variables (i.e., seizure characteristics and neuropsychological functioning) are among those that will be examined as potential correlates of peer difficulty. Prior to describing the study, the following sections will provide an overview Coie's model and further support for its use in the current study.

#### Overview of Coie's Theoretical Model

According to Coie's (1990) model, any or a combination of three variables proximal to the peer group situation may contribute to emerging peer problems (i.e., peer dislike, victimization, having few friends) in childhood (see Figure 1). These variables

include peer stigmatization, maladaptive social behaviors (i.e., social ineptness, aggression, inattentive/immature behavior, social anxiety/avoidance; Bierman, 2004; Coie, 1990; Hymel, Wagner, & Butler, 1990), and non-behavior problems (i.e., academic difficulties, poor athleticism, unattractiveness; Coie, 1990; Coie & Kupersmidt, 1983). Of these variables, Coie states that maladaptive social behaviors likely play a key role in perpetuating peer difficulties. For example, a child may have a certain condition or characteristic that triggers peer teasing and harassment (e.g., seizures), but it is the negative behavior that the child exhibits in response to peer provocation (e.g., avoiding or aggressing toward the peer group instead of reacting in a good-natured or skillful manner) that reinforces peers' initial dislike of the child (Coie, 1990). Also of import is that the degree to which some of these proximal variables play a role in peer difficulties likely differs by child sex. Studies show that anxious behaviors are associated more strongly with peer problems in girls, whereas aggressive and inattentive behaviors are related more strongly to peer difficulties in boys (Bell-Dolan, Foster, & Christopher, 1995; Bierman, 2004; Coie, Dodge, & Kupersmidt, 1990).

In addition to proximal variables, Coie (1990) posits that intermediate variables, such as how the child processes social information, have a direct effect on children's social behaviors and, therefore, play a role in peer problems. The processing of social information refers to how a child cognitively encodes, interprets, and responds to social information (Crick & Dodge, 1994). Evidence indicates that interpreting ambiguous social cues as threatening or hostile likely contribute to children's anxious and aggressive social behaviors (e.g., Barrett, Rapee, Dadds, & Ryan, 1996; Bell-Dolan, 1995; Crick & Dodge, 1994).

Coie (1990) states that deficits in how a child processes social information are due partly to distal variables such as problematic parenting. Earlier writings have touted the importance of authoritative parenting (i.e., high warmth and age-appropriate monitoring) in fostering prosocial behaviors in children (Baumrind, 1978). Furthermore, later reviews conclude that, through modeling and coaching, parents may encourage their children to interpret social situations as menacing and to adopt maladaptive social problem-solving strategies (Dodge & Feldman, 1990; Putallaz & Heflin, 1990). For example, a study by Barrett et al. (1996) found that, compared to normal children, anxious and aggressive children proposed more avoidant and aggressive plans of action, respectively, after consulting with their parents about a hypothetical social problem (e.g., joining in a peer group). Contrary to the parents of normal children, parents of anxious and aggressive children interpreted the social problems as threatening and discouraged their children from implementing prosocial solutions during the parent-child discussion (e.g., politely approaching the peer group and asking to join in; Barrett et al., 1996; Dadds, Barrett, Rapee, & Ryan, 1996). Given these findings, it seems that parents may influence how their children behave in social situations.

Based on Coie's (1990) model, several variables may potentially be associated with peer difficulties in children with epilepsy. Ideally, it would be interesting to investigate if each of these variables is related to peer problems in affected children. However, considering that little is known about variables related to peer problems in children with epilepsy and sample size constraints do not permit the investigation of variables in the entire model, the most logical first step is to determine which of the proximal variables in the framework are associated with peer problems in children with



epilepsy. Once key proximal variables are identified, future studies should investigate whether intermediate and distal variables in the model are also related with peer difficulties in children with the disorder. Within the childhood epilepsy literature, several studies have assessed if children with epilepsy experience problems with many of the proximal variables in Coie's model. Their findings, which were used to guide the selection of proximal variables included in the present study, are reviewed next.

### *Peer Stigmatization*

According to Harper (1999), the extent to which children have a condition or characteristic that is upsetting, uncontrollable, or disruptive to other children increases their chances of being stigmatized by their peers. Considering the potentially unpredictable and unusual nature of seizures (e.g., convulsions, odd behaviors, lapses in consciousness), it is possible that children with epilepsy experience peer stigmatization. Some research indicates that over a third of children with epilepsy (35%) have significant concerns about peer stigmatization (Arunkumar, Wyllie, Kotagal, Ong, & Gilliam, 2000), and a smaller percentage feel comfortable disclosing their condition to their peers compared to children with asthma or diabetes (18% vs. 100%, respectively; Houston, Cunningham, Metcalfe, & Newton, 2000). Nonetheless, no studies have examined if children with epilepsy are actually stigmatized by their peers, so it is uncertain if stigmatization is problematic for children with epilepsy compared to other children.

### *Social Behavior*

Social behaviors commonly associated with peer difficulties include (a) low rates of prosocial behavior (i.e., social ineptness), (b) high rates of aggressive/disruptive behavior, (c) high rates of inattentive/immature behavior (i.e., difficulty staying on task,

babyish/immature behaviors), and (d) high rates of socially anxious/avoidant behavior (Bierman, 2004; Coie et al., 1990; Newcomb, Bukowski, Patee, 1993; Rubin, Bukowski, & Parker, 1998). Most children who have problems with their peers exhibit at least one or a combination of these behaviors, which peers consider to be aversive and undesirable (Barkley, 1996; Bierman, 2004). Because neurological impairments have been linked to behavioral problems in children (Nassau & Drotar, 1997; Rutter, Graham, & Yule, 1970), several studies have examined if children with epilepsy are at heightened risk for maladaptive behaviors.

*Low prosocial behavior.* Only two studies have assessed some aspect of prosocial behavior (e.g., cooperation, effective communication, emotion regulation, social awareness, sensitivity) in children with epilepsy. Matthews et al. (1982) found that, based on parent reports, children with epilepsy had more negative affect and reacted less appropriately to others' distress than did healthy children or those with diabetes (Ferrari et al., 1983; Matthews et al., 1982). Parents also claimed that children with epilepsy had more problems initiating activities, showing leadership, and defending themselves against their peers (Matthews et al., 1982). Yet, because these results are from two studies that examined the same sample, it is unclear if children with epilepsy are more socially inept compared to healthy children or children with non-CNS health conditions.

*Aggressive/disruptive behavior.* Two studies examined aggression in children with epilepsy. Both Austin et al. (2002) and Schoenfeld et al. (1999) found that affected children scored about the same as did their healthy siblings on parent reports of aggression. However, because these results are based on just two studies, it is uncertain if children with epilepsy are more aggressive compared to other children.

*Inattentive/immature behavior.* A handful of studies have investigated inattentive/immature behavior in children with epilepsy. According to one study (Stores, 1978), teachers reported greater inattentive behavior in children with epilepsy than in healthy children. Moreover, Schoenfeld et al. (1999) found that children with epilepsy had higher scores compared to their siblings on parent ratings of inattentive behavior. Likewise, the meta-analyses conducted by Rodenburg et al. (2005) concluded that children with epilepsy exhibit more inattentive behavior compared to healthy children and children with other chronic health conditions. In addition, compared to parent-ratings of children with diabetes, parents rated children with epilepsy as more babyish and immature (Ferrari et al., 1983). Thus, based on these findings, it seems that children with epilepsy have more problems with inattentive/immature behavior compared to healthy children, siblings, and children with non-CNS health conditions.

*Socially anxious/avoidant behavior.* Although no studies have examined if children with epilepsy suffer from social anxiety, several have obtained broad measures of anxiety. Compared to healthy children, children with epilepsy scored higher on teacher ratings of anxiety (Stores, 1978). Moreover, relative to their siblings, children with epilepsy scored higher on measures of parent- (Long & Moore, 1979) and teacher- (Hodes et al., 1999; Long & Moore, 1979) reported neuroticism. Schoenfeld (1999) also found that children with epilepsy scored higher on a parent-rated measure of anxiety/depression, however the difference was not statistically significant. When compared to children with non-CNS health conditions, children with epilepsy rated themselves as more anxious than did children with asthma (Austin et al., 1994) and children with diabetes (Matthews et al., 1982). Although the extent to which children

with epilepsy experience social anxiety is unknown, as a whole, it appears that affected children have more anxiety relative to healthy children, siblings, or children with non-CNS health conditions.

#### *Non-Behavior Characteristics*

*Academic achievement.* Children with academic difficulties may have peer problems because they appear less capable to their peer group. Given that epilepsy is a neurological condition, children with the disorder may be at risk for academic challenges (Buelow et al., 2003). Two studies found that children with epilepsy scored lower than did their healthy peers on standardized achievement tests (Schoenfeld et al., 1999; Stores, 1978). Moreover, both parents and teachers rated children with epilepsy to be lower on academic achievement compared to their healthy siblings (Hodes et al., 1999; Schoenfeld et al., 1999) and children with asthma (Austin et al., 1994). Children with epilepsy also rated themselves lower on academic ability compared to healthy children and siblings (Hodes et al., 1999; Matthews et al., 1982) as well as children with diabetes (Matthews et al., 1982). Given these findings, it seems that children with epilepsy have more academic difficulties compared to healthy children, siblings, and children with non-CNS health conditions.

*Athleticism and appearance.* As with children who experience low achievement, children who look different may also have problems with their peers. A neurological condition such as epilepsy may be associated with physical limitations due to underlying central nervous system impairments (Nassau & Drotar, 1997). Only a few studies examined some aspect of physical ability or appearance in children with epilepsy. Sillanpaa (1992) found that, based on parent interviews, a slightly greater percentage of

children with epilepsy (3%) had ambulation difficulties compared to healthy children (0%). Furthermore, other studies revealed that children with epilepsy were no different from their siblings on self-reports of athletic competence or physical appearance (Hodes et al., 1999), nor did they differ from children with diabetes on self-reports of physical self-concept (Matthews et al., 1982). Thus, based on these findings, it appears that children with epilepsy may not be at greater risk for physical limitations compared to healthy children, siblings, or children with non-CNS health conditions.

*Child sex and peer difficulties.* Of note is that the degree to which some of the aforementioned factors relate to peer difficulties in children with epilepsy may differ by child sex. As mentioned previously, evidence suggests that anxious behavior is associated more with peer problems among girls, whereas aggressive and inattentive behavior is related more to peer difficulties among boys (Bell-Dolan et al., 1995; Coie et al., 1990; Coie, Dodge, & Coppotelli, 1982). Thus, the present study will consider potential sex differences when identifying factors that may increase the risk for peer problems in children with epilepsy.

#### *Consideration of Epilepsy-Related Variables*

Given the results from the aforementioned studies, it seems that a few of the proximal variables in Coie's (1990) model such as inattentive behavior, anxious behavior, and academic achievement are problematic for children with epilepsy relative to other children and, therefore, are the most appropriate to examine in the current study. However, other variables to consider are those that are especially relevant to children with epilepsy such as neuropsychological functioning and seizure characteristics. These variables will be discussed in the following section.

*Neuropsychological functioning.* Researchers speculate that difficulties with memory, attention, and executive functioning (e.g., planning, problem-solving, multi-tasking) may adversely affect social interactions between children and their peers (Nassau & Drotar, 1997; Semrud-Clikeman & Wical, 1999). For example, a recent study found that, in children with traumatic brain injury, inattention and executive dysfunction were related to generating fewer prosocial solutions in response to hypothetical peer group scenarios (Warschusky, Argento, Hurvitz, & Berg, 2003). Although this study did not specifically examine children with epilepsy, its findings suggest that neuropsychological functioning may influence children's social behaviors. Impairments in memory, attention, and executive functioning may also lead to achievement problems in children with epilepsy (Fastenau et al., 2004). Research on childhood epilepsy has found that affected children experience more difficulties with memory (Schoenfeld et al., 1999), attention (Schoenfeld et al., 1999; Semrud-Clikeman & Wical, 1999) and executive functioning (Hernandez et al., 2002; Schoenfeld et al., 1999) compared to healthy children. Provided these results, the present study examines if neuropsychological functioning is related to maladaptive social behaviors, academic problems, and peer difficulties in children with epilepsy.

*Seizure characteristics.* Along with neuropsychological deficits, researchers posit that seizures may have an adverse influence on children's social behaviors. For example, children with epilepsy may be anxious around their peers due to fear of having a seizure in their presence. Moreover, by reducing the exposure to positive peer group interactions, seizures may decrease the opportunity for children with epilepsy to develop prosocial behaviors (La Greca, 1990; Nassau & Drotar, 1997). Likewise, seizure

characteristics (e.g., lapses in consciousness) may make children with epilepsy act inattentive or “spacey” around their peers (Coulter, 1982). Seizures may also contribute to other variables associated with peer difficulties. Studies that investigated if seizure characteristics were related to any of the aforementioned variables found that children with epilepsy who had an active seizure status (i.e., had at least one seizure in the last year) had greater inattentive behaviors compared to children with epilepsy who had a controlled seizure status (i.e., had no seizures within the last year)(Austin et al., 2002; Williams & Sharp, 1996). Moreover, earlier age at epilepsy onset was related to greater deficits on several indicators of neuropsychological functioning, including verbal and non-verbal memory, processing speed and attention, and executive functioning (Schoenfeld et al., 1999). Schoenfeld and colleagues also found that younger age at onset was related to lower academic achievement. Given the above findings, the current study investigates if seizure characteristics (i.e., seizure status and age at epilepsy onset) are associated with peer difficulties and other variables (i.e., social behaviors, academic performance, and neuropsychological functioning) in children with epilepsy.

#### Purpose of the Present Study

Although the literature on peer relations in children with epilepsy has examined several variables relevant to peer difficulties, much of the research has progressed without benefit of a theoretical framework to guide research and organize findings. Adopting such a framework would advance this literature in several ways. First, using components of an established model of peer difficulties permits us to organize existing research on peer relationships in children with epilepsy and to identify gaps in knowledge. Second, using a developmental psychopathology approach allows for an

initial examination of the extent to which variables related to peer problems in children with epilepsy are similar to those in typically developing children and the degree to which epilepsy-related variables contribute important information to our understanding of patterns of peer difficulty. Third, by providing a more comprehensive and theoretically-grounded understanding of variables associated with peer relationship problems in children with epilepsy, interventions that address peer difficulties in children with the disorder may be modified accordingly. Thus, the purpose of the current study is to examine peer difficulties in children with epilepsy within the context of a developmental psychopathology framework of peer relationship difficulties while also considering epilepsy-related variables.

#### Study Model and Hypotheses

Figure 2 presents the model that will be investigated in the present study. Given the results from existing research, it appears that some of the proximal variables delineated in Coie's (1990) model are of particular relevance to children with epilepsy, including inattentive behavior, anxious behavior, and academic achievement. Other variables such as neuropsychological functioning and seizure characteristics also seem especially relevant to social issues in children with epilepsy, and so this study expands Coie's model to incorporate these variables. Social behavior (anxious, inattentive) and academic achievement are presumed to relate directly to peer difficulties in children with epilepsy. Epilepsy-related variables, including seizure characteristics and neuropsychological functioning, are presumed to have both direct relations to peer difficulties and indirect relations through children's anxious and inattentive behavior and



academic achievement. Although not illustrated in the figure, some of the proposed relationships are also expected to be moderated by child sex, as described below.

Table 1 lists specific hypotheses of the current study. Existing literature suggests that children with epilepsy have greater problems with inattentive behavior, anxious behavior, and academic achievement compared to other children. Therefore, the first hypothesis is that greater problems with each of these three variables will be associated with peer difficulties in children with epilepsy.

In regard to epilepsy-related variables, the second hypothesis states that deficits in neuropsychological functioning (i.e., memory, attention, executive functioning) and seizure characteristics (i.e., earlier age at onset, active seizure status) will each be related to peer problems in children with epilepsy. Hypothesis Three claims that deficits in neuropsychological functioning will be related to inattentive behavior, anxious behavior, and lower academic achievement. Moreover, Hypothesis Four posits that seizure characteristics will be related to deficits in neuropsychological functioning, inattentive behavior, anxious behavior, and lower academic achievement.

Pertaining to the potential mediational role that proximal variables (i.e., social behavior and academic achievement) have in the relation between epilepsy-related variables (i.e., neuropsychological functioning and seizure characteristics) and peer difficulties, the fifth hypothesis states that inattentive behavior, anxious behavior, and academic achievement will each mediate the relation between neuropsychological functioning and peer problems. Hypothesis Six states that neuropsychological functioning will mediate the relation between seizure characteristics and each proximal factor (i.e., inattentive behavior, anxious behavior, and academic achievement). In

addition, the seventh hypothesis posits that neuropsychological functioning, inattentive behavior, anxious behavior, and academic achievement will mediate the association between seizure characteristics and peer problems.

Finally, due to evidence in the broader peer relations literature that the associations between some of the aforementioned variables (i.e., inattentive and anxious behaviors) and peer difficulties varies by child sex (e.g., Coie et al., 1990), the eighth hypothesis is that anxious behavior will be associated more strongly with peer problems in girls with epilepsy, whereas inattentive behavior will be related more strongly to peer difficulties in boys with epilepsy.

## Methods

### *Participants*

Data for the present study were taken from an existing, de-identified dataset at the Indiana University School of Nursing (funded by the National Institute of Nursing Research grant PHS R01 NR04536 awarded to Joan K. Austin, DNS, RN, FAAN). Data were collected from 1997-2003 on 173 children (49% female), ages 8.5 to 15.1 years ( $M[SD] = 11.74[1.85]$ ), who had a diagnosis of epilepsy for at least six months. Fifteen percent of the sample had generalized tonic-clonic, myoclonic, or atonic seizures as their primary seizure type; 62% had complex or simple partial seizures as their primary seizure type; 23% had absence seizures as their primary seizure type. The children's mothers (98.8% biological mothers, 1.2% step-mothers) and teachers also participated in the study. The majority of the children were Caucasian (91.3%), 5.8% were African-American, 0.6% were Asian, and 2.3% were bi-racial. Most children (71.3%) came from two parent households. The mothers' average education level was 13.5 years ( $SD = 2.3$

years, range = 8 – 20 years). Complete information on household income is not available. All children were taking antiepileptic medications at the time of enrollment. Children were recruited from out-patient pediatric neurology clinics, private pediatric neurology practices, and schools within Indiana and neighboring areas. Letters, brochures, and flyers were sent to nurses at all schools on a mailing list provided by the State of Indiana. In addition, all child neurology clinics in the Greater Indianapolis area were contacted and provided letters, brochures, and flyers describing the study. Children were excluded from participation in the original study if they had another chronic physical condition, had been diagnosed with mental retardation, and/or had been classified by the schools as mentally disabled (based on parent report of the school's evaluation). Approximately 351 children were initially contacted regarding participation in the original study. Of the 178 children who did not participate, 39 (22%) met criteria for participation but were not interested, 11 (6%) could not be contacted, 43 (24%) did not meet the medication criteria (i.e., must be currently taking anti-epileptic medication), 6 (3%) did not meet the age criteria, 19 (11%) did not meet the diagnosis criteria (i.e., must be diagnosed with epilepsy for at least 6 months), 10 (6%) did not meet health criteria (i.e., must not have another chronic illness such as asthma), 22 (12%) did not meet the cognitive criteria (i.e., no diagnosis of mental retardation or being classified as mentally disabled by the schools), and 28 (16%) met all the inclusion criteria but dropped out after enrollment in the study. Hence, roughly 9% of the 351 children who were initially contacted were excluded from the study due to a co-morbid diagnosis of another chronic health condition or mental retardation. Additional information about the existing

dataset may be found in recent published articles by Austin and colleagues (e.g., Buelow et al., 2003; Fastenau et al., 2004).

### *Procedure*

The institutional review board (IRB) at Indiana University approved both the original and current studies. Because the dataset is de-identified, obtaining approval from the IRB at the University of Missouri-Columbia to conduct the present study was not necessary (J. Greening, personal communication, August 18, 2005). For the original study, the children's mothers signed informed consent statements before participation, and the children gave informed assent. Mothers and children completed separate interviews by phone with a carefully trained nurse or clinical research assistant; demographic, behavioral, and seizure data were obtained as part of the interviews. Teachers who knew the child well (per mother report) were sent questionnaires via mail to complete about the child. Children also underwent a comprehensive neuropsychological evaluation at the medical center. Neuropsychological testing was conducted individually by trained psychometrists. Children and teachers were compensated \$25 and mothers were compensated \$50 for their participation in the original study.

### *Measures*

Measures relevant to the present study are described in this section and listed in Table 2. Additional information about other measures in the dataset may be obtained from Buelow et al. (2003) and Fastenau et al. (2004).

*Demographics.* During the phone interview with the parent, demographic information such as child age, child sex, child race/ethnicity, parent education, and family income were assessed. Appendix A includes a copy of the demographic form.

*Peer difficulties.* Children's peer difficulties were examined using four different indicators. The Popularity subscale from the Piers-Harris Children's Self-Concept Scale (CSCS; Piers, 1984) was used to obtain self-report of children's peer relationships. The CSCS is an 80-item self-report measure suitable for measuring self-concept in children ages 8 to 18 years. The CSCS assesses six areas of children's self-concept including anxiety, behavior, happiness and satisfaction, physical appearance, intellectual and school status, and popularity. The Popularity subscale is a dichotomous (i.e., no = 0, yes = 1), 12-item scale that contains statements such as "It's hard for me to make friends" and "I am unpopular." Items are summed to yield a total raw score; a higher score indicates greater popularity. The internal consistency reliability for the Popularity subscale is acceptable ( $\alpha = .74$ ; Piers, 1984). There is no information on the validity of the CSCS subscales, however the total CSCS is positively related to measures of peer acceptance and other measures of self-concept (Byrne, 1996; Piers, 1984).

Parent and teacher reports of children's peer relationships were examined using the Child Behavior Checklist (CBCL; Achenbach, 1991a) and the Teacher Report Form (TRF; Achenbach, 1991b), respectively. The CBCL, which measures child competence and behavior problems, may be completed about children between 4 and 18 years of age. Research indicates that the CBCL is a practical and objective tool for assessing maladjustment in children with epilepsy (Dorenbaum, Cappelli, Keene, & McGrath, 1985). The TRF, which measures child academic performance, adaptive functioning, and

behavior problems, may be completed about children between 5 and 18 years of age. Both the CBCL and the TRF have eight narrow band scales that assess behavior problems. These include Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior subscales. These eight scales can be combined to yield broad band scores of internalizing and externalizing behaviors. The competence portion of the CBCL is comprised of the Activities, Social, and School subscales, which can be combined to yield a Total Competence score. The adaptive functioning portion of the TRF contains global questions about the child's overall behavior, level of happiness, work ethic, and ability to learn.

For the present study, the CBCL Social Competence subscale and the CBCL and TRF Social Problems subscales were utilized to examine peer difficulties in children with epilepsy. The Social Competence subscale has four items, which ask about the number of social organizations the child is involved in as well as assesses, using a 4-point scale, the extent to which the child is involved in each organization. The items also ask how many friends the child has and how well he or she gets along with friends, peers, and parents. The CBCL and TRF Social Problems subscales have 8 and 13 items, respectively. Parents and teachers rate each of the items (e.g., "Doesn't get a long with other kids", "Gets teased a lot") using a 3-point scale. Raw scores for each of the CBCL and TRF subscales can be converted to standardized scores based on child sex and age. However, per manual recommendations (Achenbach, 1991a), raw scores were used in the current study to maximize sensitivity to variability at the low (i.e., less problematic) end of the range of possible scores. Internal consistency reliability for the CBCL Social

Competence subscale is low (alphas = .54 - .61 across age and sex groups; Achenbach, 1991a), which is likely because this subscale assesses diverse aspects of social competence. Internal consistency reliabilities for the CBCL and TRF Social Problems subscales are higher (CBCL alphas = .72 - .76, TRF alphas = .84 - .87; Achenbach, 1991a, 1991b). The CBCL Social Competence, CBCL Social Problems, and the TRF Social Problems subscales each are able to sufficiently discriminate non-clinically referred children from referred children (Achenbach, 1991a, 1991b). Moreover, the CBCL Social Problems subscale is moderately related to peer-nominated social preference in normally developing children (Schwartz, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999), which shows that it has concurrent validity with other indicators of peer relationships. The CBCL and TRF Social Problems subscales are moderately to highly related ( $r_s = .57 - .73$  across age and sex groups; Achenbach, 1991a, 1991b), which indicates that they may each contribute uniquely to the assessment children's peer difficulties.

*Inattentive behavior.* Children's inattentive behavior was investigated using the CBCL and TRF Attention Problems subscales. The CBCL and TRF Attention Problems subscales have 11 and 20 items, respectively (e.g., "Can't concentrate, can't pay attention for long"), each rated on a 3-point scale. As with other CBCL and TRF subscales, raw scores were used in the present study. Internal consistency reliabilities for both the CBCL and TRF Attention Problems subscales are good (alphas = .83 - .84 and .93 - .95, respectively). Moreover, both subscales adequately discriminate between non-clinically referred and referred children (Achenbach, 1991a, 1991b), and the CBCL Attention Problems subscale discriminates children with attention-deficit hyperactivity disorder

(ADHD) from children without ADHD (Biederman, Faraone, Mick, Moore, & Lelon, 1996). Associations between the CBCL and TRF Attention Problems subscales across child age and sex are medium to strong ( $r_s = .48 - .70$ ; Achenbach, 1991a, 1991b).

*Anxious behavior.* The Anxiety subscale of the CSCS and the Anxious/Depressed subscales of the CBCL and TRF were used to examine children's anxious behavior. The CSCS Anxiety subscale is a dichotomous (i.e., no = 0, yes = 1), 14-item scale that contains statements such as "I am nervous" and "I am shy." Items are summed to yield a total raw score; a higher score indicates less anxiety. The internal consistency reliability for the Anxiety subscale is acceptable ( $\alpha = .77$  in Piers, 1984). As noted earlier, validity information for the Anxiety subscale is not available.

The CBCL and TRF Anxious/Depressed subscales have 14 and 18 items, respectively ("Feels worthless or inferior", "Nervous, high-strung, tense"), rated on a 3-point scale. Internal consistency reliabilities across age and sex for the CBCL and TRF Anxious/Depressed subscales are good ( $\alpha_s = .86 - .88$  and  $.88 - .89$ , respectively). In addition, both subscales adequately discriminate between non-clinically referred and referred children (Achenbach, 1991a, 1991b), and the CBCL Anxious/Depressed subscale discriminates depressed children from non-depressed children (Biederman et al., 1996). Correlations between the CBCL and TRF Anxious/Depressed subscales across child age and sex are moderate ( $r_s = .33 - .48$ ; Achenbach, 1991a, 1991b).

*Academic achievement.* The Reading, Mathematics, and Writing clusters of the standard achievement battery of the Woodcock-Johnson Psychoeducational Battery – Revised (WJR; Woodcock & Johnson, 1989) were used to investigate children's academic achievement. The WJR assesses achievement in individuals from 2 years of



age through adulthood. Each cluster has two subtests (Reading = letter-word identification and passage comprehension; Mathematics = calculation and applied problems; Writing = dictation and writing samples); subtest scores are standardized based on child age. Internal consistency reliabilities of the subtests comprising the Reading, Mathematics, and Writing clusters are strong, with alphas ranging from .90 (i.e., passage comprehension) to .93 (i.e., calculation and writing samples). The clusters also show good concurrent validity, as evidenced by their strong relation to other indicators of achievement (Sattler, 1992; Woodcock & Johnson, 1989).

*Neuropsychological functioning.* Using the current sample, Fastenau et al. (2004) conducted an exploratory factor analysis of 16 neuropsychological indicators and found that those measures that assessed memory, attention, and executive functioning loaded onto one factor, which significantly predicted achievement problems in children with epilepsy. Hence, the same measures Fastenau and colleagues used to measure memory, attention, and executive functioning were used in the present study and were grouped as one neuropsychological construct rather than treated as individual variables.

Memory was assessed with the Story Memory, Design Memory, and Verbal Learning subtests of the Wide Range Assessment of Memory and Learning (WRAML; Adams & Sheslow, 1990), which examine children's verbal memory, visual memory, and learning performance, respectively. The WRAML assesses memory and learning in individuals between the ages of 5 to 17 years. Scores are standardized based on age. The median internal consistency reliabilities are good (alphas = .86, .85, and .88 for Story Memory, Design Memory, and Verbal Learning, respectively). Each memory subtest is

related to other indicators of memory, which suggests that they demonstrate adequate concurrent validity (Adams & Sheslow, 1990; Bigler & Adams, 2001).

Attention was assessed with the Conners' Continuous Performance Test (CPT; Conners, 1995). The CPT, intended for children ages 6 to 17 years, is a computer program that measures attention based on the speed and accuracy of children's responses to presented stimuli (e.g., letters). The test provides 12 indicators of attention (e.g., omissions, commissions, variability, perseverations), which are each standardized based on the child's age and sex. The hit reaction time standard error (Hit RTSE) was used to measure attention for the present study. The Hit RTSE assesses how inconsistent a child's reaction time is to a given stimulus, such that greater variability is related to more severe attention problems. There does not appear to be published information about the reliability of the Hit RTSE, however a study that examined the CPT reliability during its development indicated that test-retest reliabilities for the CPT subscales were low (.65 to .74), which may be due, in part, to practice effects (Halperin, Sharma, Greenblatt, & Schwartz, 1991). Regarding validity, the CPT adequately discriminates between children with and without attention problems (Conners, 1995; Epstein et al., 2003).

Finally, executive functioning was examined with the Children's Category Test (CCT; Boll, 1993). The CCT assesses non-verbal learning, memory, concept formation, and problem-solving abilities in children ages 5 to 16 years. Test scores are standardized based on child age. Split-half reliabilities for the CCT range from .86 to .88 across age groups. Concurrent validity of the CCT is adequate; it is moderately related to other measures of cognitive ability such as intelligence (Boll, 1993; Moore, Donders, & Thompson, 2004).

Of note is that Fastenau et al. (2004) speculated that the single neuropsychological factor that contains memory, attention, and executive functioning may represent broader cognitive abilities akin to global intelligence. Thus, children's scores on the Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1983) were also examined in the present study to see which factor, IQ or neuropsychological functioning, was more strongly associated with peer difficulties and other related variables in children with epilepsy. The K-BIT has two subscales, vocabulary and matrices, which assess verbal and non-verbal intelligence, respectively, in individuals age 4 to adulthood. Subscale scores are standardized based on age. Split-half reliabilities for the K-BIT's vocabulary and matrices subtests are good (.91 and .85, respectively). Moreover, the K-BIT is highly correlated with comprehensive tests of IQ such as the Wechsler scales (Kaufman & Kaufman, 1983).

*Seizure characteristics.* As indicated previously, evidence shows that certain seizure characteristics (i.e., age at epilepsy onset and seizure status) are related to maladjustment in children with the disorder (e.g., Austin et al., 2002; Schoenfeld et al., 1999). Information about age at epilepsy onset was obtained from parent reports and medical chart reviews. The age at onset variable was calculated by taking the child's date of epilepsy diagnosis and subtracting his or her date of birth. The resulting value was the child's age at epilepsy onset in years. Information about seizure status (active = having at least one seizure in the 12 months; controlled = having no seizures in the 12 months) was collected from parent reports and medical chart reviews.

## Results

Descriptive statistics and bivariate relations (e.g., Pearson product-moment correlations and t-tests) in the variables in the present study were examined using SPSS for Windows (version 14.0). Structural equation modeling was used to investigate the direct, mediated, and moderated relations among the variables. SEM allows for the simultaneous analysis of multiple, complex relations, including direct and indirect effects, among latent variables of interest (Dilalla, 2000). Power analyses revealed that the sample size for the present study ( $N = 173$ ) was sufficient for the use of SEM.<sup>2</sup> The Amos 6.0 statistical program and the maximum likelihood estimation method were employed for all SEM analyses.

### *Descriptive Statistics*

Prior to investigating the research hypotheses, descriptive statistics for each study measure were examined. Table 3 lists the descriptive statistics for the continuous variables. Regarding the sole categorical variable, seizure status, of the 171 children who had seizure status information, 118 of them (70%) had active seizures. Sample sizes in Table 3 reveal that several of the study measures had incomplete data, which was mainly due to data collection procedures. It was more challenging to obtain valid neuropsychological assessment information and to have teachers complete and return questionnaires than it was to have parents and children complete questionnaires (J. Austin and colleagues, personal communication, November 2005). Therefore, it is unlikely that the data were missing at random. However, there were no significant differences between those children with and without missing data on the remaining non-missing variables. Internal consistency reliabilities for each of the behavior subscales were

adequate. Reliability information on the CBCL Social Competence subscale and each of the achievement and neuropsychological measures was unavailable in the study dataset and, due to the format in which the dataset was provided, could not be calculated.

Examination of box and stem and leaf plots indicated outliers one step from the inter-quartile range for several variables (CBCL Social Problems subscale 1, CBCL Anxious/Depressed subscale = 3, TRF Social Problems subscale = 5, TRF Anxious/Depressed subscale = 4, WJR Reading Cluster score = 1, WJR Mathematics Cluster score = 1, and WJR Writing Cluster score = 3) and outliers two steps from the inter-quartile range for a couple variables (TRF Social Problems subscale = 2 and TRF Anxious/Depressed subscale = 1). The two step outliers were, at most, one to two points beyond the most extreme one step outliers. For each outlier, scores on each of the other measures were examined to see if the outlier score was theoretically consistent with scores on the other measures (e.g., cases with high outliers on TRF Social Problems subscale also having active seizure status, earlier age at epilepsy onset, and greater maladaptive social behaviors). Cases with outliers typically had an earlier age at epilepsy onset and active seizure status, which implied that the outliers may have been true cases of more severe problems versus the result of data entry errors. Hence, outliers were not changed (i.e., substituted by the next most extreme score) or deleted since they were likely a valid assessment of the child's adjustment. Inspection of the box plots, stem and leaf plots, and skewness also revealed that the TRF Social Problems and Anxious/Depressed subscales were skewed (i.e., skewness = 1.58), although the extent of skewness was consistent with the distribution of the TRF normative data (Achenbach, 1991) and was not considered severe enough to transform.

### *Bi-variate Analyses*

Pearson Product Moment correlations and t-tests among the study measures are presented in Table 4. Correlations among the intra-construct measures were all statistically significant ( $ps < .01$  to  $.0001$ ). Interrelations among measures comprising the peer difficulties factor were small to moderate in magnitude, ranging from  $r = .22$  (i.e., CSCS Popularity subscale with CBCL Social Competence subscale) to  $.46$  (i.e., CBCL Social Problems subscale with TRF Social Problems subscale). The correlation between the two measures comprising the inattentive behavior factor was moderate ( $r = .48$ ). Interrelations among measures comprising the anxious behavior factor were also moderate, ranging from  $r = -.31$  (i.e., CSCS Anxiety subscale with TRF Anxious/Depressed subscale) to  $-.39$  (i.e., CBCL Anxious/Depressed subscale with CSCS Anxiety subscale). Interrelations among measures comprising the academic achievement factor were large and ranged from  $r = .78$  (i.e., WJR Mathematics Cluster score with WJR Writing Cluster score) to  $.85$  (WJR Reading Cluster score with WJR Writing Cluster score). Correlations among measures comprising the neuropsychological functioning factor were small to large in magnitude, ranging from  $r = .21$  (i.e., WRAML Design Memory subscale with CCT) to  $.52$  (i.e., WRAML Story Memory subscale with WRAML Verbal Learning subscale). The correlation between the two measures comprising the IQ factor (K-BIT Vocabulary subtest and K-BIT Matrices subtest) was large ( $r = .62$ ). Finally, children with active seizures did not differ from children with controlled seizures on age at epilepsy onset ( $t = -.174, p = .862$ ).<sup>3</sup> Hence, the hypothesized model in Figure 2 was revised so that age at epilepsy onset and seizure status were separate manifest indicators (see Figure 3). Also, because the K-BIT

subscales were related to several of the study variables, two versions of the hypothesized model, the original model with the neuropsychological factor and an alternate model with the IQ factor substituted for the neuropsychological factor, were tested to determine which one fit the data best.

Pearson Product Moment correlations, t-tests, and chi-square tests between the study measures and parent education level, child age, child sex, and child race (i.e. white vs. non-white) are illustrated in Table 5. Parent education level was related to scores on the WJR Writing Cluster ( $r = .16, p < .05$ ). Child age was significantly related to several of the measures including the CBCL Anxious/Depressed subscale ( $r = -.19, p < .05$ ), the TRF Social Problems subscale ( $r = -.19, p < .05$ ), the TRF Attention Problems subscale ( $r = -.34, p < .0001$ ), the CSCS Popularity subscale ( $r = .16, p < .05$ ), the CPT Hit RTSE ( $r = -.27, p < .001$ ), the WRAML Design Memory subscale ( $r = .16, p < .05$ ), the WRAML Verbal Learning subscale ( $r = .19, p < .05$ ), and age at epilepsy onset ( $r = .16, p < .05$ ). Thus, the best fitting model was tested with and without the child age variable included.

In regard to child sex, scores on the CSCS Anxiety subscale were lower for girls ( $M[SD] = 8.3 [3.4]$ ) than they were for boys ( $M[SD] = 10.5 [2.8]$ ;  $t = 4.633, p < .0001$ ), scores on the WRJ Writing Cluster were lower for boys ( $M[SD] = 81.4 [16.3]$ ) than they were for girls ( $M[SD] = 86.7 [16.1]$ ;  $t = -2.067, p < .05$ ), and scores on the WRAML Story Memory subscale were lower for boys ( $M[SD] = 7.5 [3.6]$ ) than they were for girls ( $M[SD] = 8.6 [3.7]$ ;  $t = -1.982, p < .05$ ). As for child race, white children developed epilepsy at an earlier age ( $M[SD] = 5.8 [3.7]$ ) than did non-white children ( $M[SD] = 8.0 [3.5]$ ;  $t = -2.221, p < .05$ ).

### *Preliminary Analyses*

*Identifying the best fitting model.* Structural equation modeling was used to determine which model, the hypothesized model with the neuropsychological factor (see Figure 3) or the alternate model with the IQ factor, fit the data best and would be used to investigate each of the study hypotheses in Table 1. The hypothesized model with the neuropsychological factor was examined first. A measurement model was first tested using maximum likelihood confirmatory factor analysis to ascertain if the manifest indicators loaded onto their hypothesized latent constructs. The model included the peer difficulties, inattentive behavior, anxious behavior, academic achievement, and neuropsychological functioning latent factors. It also included the age at epilepsy onset and seizure status manifest variables so that their correlations with the model's latent factors could be examined. In order to control for common method variance among the behavioral measures, error terms were allowed to covary among measures with the same rater (e.g., CBCL Social Problems subscale with CBCL Attention Problem subscale). Because most scales had some missing data, Amos 6.0 used full information maximum likelihood (FIML) to calculate the model estimates, which, compared to other methods commonly used to deal with non-random missing data (i.e., listwise and pairwise deletion), yields the least biased results (Byrne, 2001).

When the measurement model was first tested, modification indices<sup>4</sup> revealed that model fit would be improved substantially by covarying the CCT and WJR Mathematics Cluster score error terms and the CPT Hit RTSE and the TRF Attention Problems subscale error terms. These changes made conceptual sense, and so the measurement model was re-tested with relevant error terms allowed to covary. The



resulting model demonstrated a good fit to the data ( $\chi^2$  [127] = 133.058,  $p$  = .339; CFI = .996; RMSEA = .017 with a 90% confidence interval of .000 to .042).<sup>5</sup> Table 6 lists the correlations among the model variables as well as the standardized indicator loadings for each measured variable onto their latent factors. All correlations and all standardized indicator loadings were statistically significant and in the hypothesized directions.

Because the measurement model demonstrated a good fit to the data, the hypothesized structural model (see Figure 3) was tested. Error terms that were covaried in the measurement model were left to covary in the structural model. Moreover, the residual terms between the inattentive behavior and anxious behavior factors were covaried because the two factors were related to one another. The initial test of the structural model demonstrated a good fit to the data ( $\chi^2$  [129] = 133.626,  $p$  = .372; CFI = .997; RMSEA = .014 with a 90% confidence interval of .000 to .040). A depiction of the structural model with the standardized path coefficients is illustrated in Figure 4.<sup>6</sup>

The alternate model with the IQ factor substituted for the neuropsychological functioning factor was then examined. The model included the peer difficulties, inattentive behavior, anxious behavior, academic achievement, and IQ latent factors. It also included the age at epilepsy onset and seizure status manifest variables so that their correlations with the model latent factors could be examined. As with the previous model, error terms were allowed to covary among those behavioral measures with the same rater. Modification indices from the initial test of the model revealed that model fit would improve if the error terms between the K-BIT Matrices subscale and WJR Mathematics Cluster score were allowed to covary, which made conceptual sense. Therefore, these two terms were covaried and the model was re-tested. Results indicated

that the model demonstrated good fit to the data ( $\chi^2 [80] = 93.383, p = .145; CFI = .991; RMSEA = .031$  with a 90% confidence interval of .000 to .055). Table 7 shows the correlations among the model variables as well as the standardized indicator loadings for each measured variable onto their latent factors. All correlations, except the relation between the anxious behavior and age at epilepsy onset variables, and all standardized indicator loadings were statistically significant and in the hypothesized directions.

Because the measurement model with the IQ factor demonstrated a good fit, the structural model was then tested. Those error terms that were covaried in the measurement model were left to covary in the structural model. Likewise, the residual terms between the inattentive behavior and anxious behavior factors were covaried because the two factors were related to one another. The initial test of the structural model demonstrated a good fit to the data ( $\chi^2 [82] = 94.120, p = .170; CFI = .992; RMSEA = .029$  with a 90% confidence interval of .000 to .053); however the fit was not quite as good compared to the fit of the model with neuropsychological functioning. In addition, the relations between the IQ and academic achievement factors in the alternate measurement and structural models were extremely high (both  $r$  and standardized path coefficient = .96), which implies that including the IQ factor in the model was likely redundant. A depiction of the structural model with the standardized path coefficients is illustrated in Figure 5. Given that the hypothesized model with the neuropsychological factor demonstrated better fit to the data compared to the alternate model with the IQ factor, the former was used for the remainder of the study analyses.

*Inclusion of child age.* Prior to investigating the study hypotheses, the hypothesized model was tested with child age included as a covariate to determine if it

would improve model fit. Inclusion of child age yielded good model fit ( $\chi^2 [143] = 167.637, p = .078; CFI = .983; RMSEA = .032$  with a 90% confidence interval of .000 to .050). Figure 6 illustrates the model. As can be seen, child age was only related to age at epilepsy onset and the inattentive behavior factor. Moreover, the model fit with child age was not as good as the model fit without child age. Thus, the model without child age was used for all subsequent analyses.

#### *Associations Among Study Constructs*

Hypotheses One through Four predicted significant associations among constructs in the conceptual model presented in Figure 3. These hypotheses were examined using the measurement model information provided in Table 6. Hypothesis One and Two, which posited that the behavioral/academic variables (inattentive behavior, anxious behavior, and lower academic achievement) and neuropsychological and seizure variables (i.e., earlier age at epilepsy onset and active seizure status) would be associated with peer difficulties, were supported. Correlations between peer difficulties and inattentive behavior ( $r = .86, p < .0001$ ), anxious behavior ( $r = .86, p < .0001$ ), academic achievement ( $r = -.43, p < .0001$ ), neuropsychological functioning ( $r = -.54, p < .0001$ ), age at epilepsy onset ( $r = -.26, p < .01$ ), and seizure status ( $r = .21, p < .05$ ) were all significant and in the predicted directions. Hypothesis Three, which asserted that deficits in neuropsychological functioning would be related to inattentive behavior, anxious behavior, and lower academic achievement, was also supported. Correlations between neuropsychological functioning and inattentive behavior ( $r = -.59, p < .0001$ ), anxious behavior ( $r = -.33, p < .01$ ), and academic achievement ( $r = .79, p < .0001$ ) were all significant and in the predicted direction. Finally, Hypothesis Four, which stated that

seizure characteristics (i.e., lower age at epilepsy onset and active seizure status) would be related to deficits in neuropsychological functioning, inattentive behavior, anxious behavior, and lower academic achievement, was partially supported. Relations between age at epilepsy onset and neuropsychological functioning ( $r = .30, p < .01$ ), inattentive behavior ( $r = -.26, p < .01$ ), anxious behavior ( $r = -.20, p < .05$ ), and academic achievement ( $r = .21, p < .01$ ) were all significant and in the predicted direction. Bivariate analyses in Table 2 revealed that seizure status was not related to neuropsychological functioning or academic achievement, so the relations between seizure status and these two variables were not examined in the measurement model. However, correlations between seizure status and inattentive behavior ( $r = .18, p < .05$ ) and anxious behavior ( $r = .23, p < .05$ ) were each significant and in the predicted direction.

#### *Mediational Relationships Among Study Constructs*

Given that the overall structural model demonstrated good fit, Hypotheses Five through Seven, which each posited the existence of mediated relations in the model, were investigated. According to Baron and Kenny (1986), three conditions must be met in order to establish the presence of a mediational effect: (a) the predictor variable must be significantly related to the mediating variable; (b) the mediating variable must be significantly related to the criterion variable; (c) the predictor variable must be significantly related to the criterion variable. Each condition was considered prior to examining the hypothesized mediated relations.

*Mediation of relationship between neuropsychological functioning and peer difficulties.* Hypothesis Five states that inattentive behavior, anxious behavior, and

academic achievement would each mediate the relation between neuropsychological functioning and peer difficulties. Correlations from the measurement model (see Table 6) tested in Hypotheses One through Three, indicated that the three conditions for testing these mediated relations were met. Standardized path coefficients among the variables in the hypothesized mediated model are presented in Figure 4. The standardized total effect (i.e., direct plus indirect effects) of neuropsychological functioning on peer difficulties was  $-.51$ . The direct path from neuropsychological functioning to peer difficulties was not statistically significant (standardized path coefficient =  $-.14$ ,  $p = .293$ ). Direct paths from neuropsychological functioning to inattentive behavior (standardized path coefficient =  $-.57$ ,  $p < .0001$ ), anxious behavior (standardized path coefficient =  $-.30$ ,  $p < .01$ ), and academic achievement (standardized path coefficient =  $.80$ ,  $p < .0001$ ) were all significant and in the predicted direction. Direct paths from inattentive behavior to peer difficulties (standardized path coefficient =  $.39$ ,  $p < .01$ ) and anxious behavior to peer difficulties (standardized path coefficient =  $.54$ ,  $p < .0001$ ) were each significant and in the predicted direction, but the direct path from academic achievement to peer difficulties was not significant (standardized path coefficient =  $.01$ ,  $p = .995$ ). Examination of indirect paths revealed that inattentive behavior mediated the relation between neuropsychological functioning and peer difficulties (standardized indirect effect =  $-.22$ ; Sobel's test statistic =  $-2.56$ ,  $p < .01$ ), anxious behavior mediated the relation between neuropsychological functioning and peer difficulties (standardized indirect effect =  $-.16$ ; Sobel's test statistic =  $-2.26$ ,  $p < .05$ ), but academic achievement did not mediate the relation between neuropsychological functioning and peer difficulties (standardized indirect effect =  $.01$ ; Sobel's test statistic =  $0.05$ ,  $p = .960$ ). Hence, except for academic

achievement not mediating the relation between neuropsychological functioning and peer difficulties, Hypothesis Five was supported.

Additional analyses were performed to determine if a) neuropsychological functioning related to any of the mediating variables more strongly and b) any of the mediating variables related more strongly to peer difficulties. In regard to the former, constraining the neuropsychological functioning to the inattentive behavior, anxious behavior, and academic achievement paths to be equal resulted in a statistically significant change in model fit (change in  $\chi^2$  [2] = 123.118,  $p < .0001$ ). Constraining paths to be equal in pairs (i.e., academic achievement and anxious behavior, academic achievement and inattentive behavior, inattentive behavior and anxious behavior) also resulted in a significant change in model fit (academic achievement and anxious behavior change in  $\chi^2$  [1] = 100.618,  $p < .0001$ ; academic achievement and inattentive behavior change in  $\chi^2$  [1] = 121.255,  $p < .0001$ ; inattentive behavior and anxious behavior change in  $\chi^2$  [1] = 24.425,  $p < .0001$ ), which indicates that neuropsychological functioning predicted academic achievement the strongest followed by inattentive behavior and then anxious behavior. In regard to the latter, constraining the inattentive behavior to peer difficulties path, anxious behavior to peer difficulties path, and academic achievement to peer difficulties path to be equal resulted in a statistically significant change in model fit (change in  $\chi^2$  [2] = 37.664,  $p < .0001$ ). Constraining paths to be equal in pairs (i.e., academic achievement and anxious behavior, academic achievement and inattentive behavior, inattentive behavior and anxious behavior) also resulted in a significant change in model fit (academic achievement and anxious behavior change in  $\chi^2$  [1] = 12.675,  $p < .001$ ; academic achievement and inattentive behavior change in  $\chi^2$  [1] = 7.362,  $p < .01$ ;

inattentive behavior and anxious behavior change in  $\chi^2 [1] = 4.866, p < .05$ ), which shows that anxious behavior predicted peer difficulties the strongest followed by inattentive behavior and then academic achievement.

*Mediation of relationships between seizure characteristics and behavioral/academic variables.* Hypothesis Six posited that neuropsychological functioning would mediate the relation between seizure characteristics (age at epilepsy onset and seizure status) and behavioral/academic variables (inattentive behavior, anxious behavior, academic achievement). Because seizure status was not related to neuropsychological functioning (see Table 6), the conditions were not met to examine this hypothesis for seizure status. However, conditions were met to investigate the hypothesis using age at epilepsy onset.

The standardized total effect (i.e., direct plus indirect effects) of age at epilepsy onset on inattentive behavior was  $-.26$ . The direct path from age at epilepsy onset to inattentive behavior was not statistically significant (standardized path coefficient =  $-.09, p = .289$ ), but the direct paths from age at epilepsy onset to neuropsychological functioning and from neuropsychological functioning to inattentive behavior were both statistically significant (standardized path coefficients =  $.30, p < .001$  and  $-.57, p < .0001$ , respectively). Examination of the indirect path revealed that neuropsychological functioning mediated the relation between age at epilepsy onset and inattentive behavior (standardized indirect effect =  $-.17$ ; Sobel's test statistic =  $-2.60, p < .01$ ).

The standardized total effect (i.e., direct plus indirect effects) of age at epilepsy onset on anxious behavior was  $-.20$ . The direct path from age at epilepsy onset to anxious behavior was not statistically significant (standardized path coefficient =  $-.11, p$

= .253), although the direct paths from age at epilepsy onset to neuropsychological functioning and from neuropsychological functioning to anxious behavior were both statistically significant (standardized path coefficients = .30,  $p < .001$  and  $-.30$ ,  $p < .01$ , respectively). Examination of the indirect path revealed that neuropsychological functioning mediated the relation between age at epilepsy onset and anxious behavior (standardized indirect effect =  $-.09$ ; Sobel's test statistic =  $-1.98$ ,  $p < .05$ ).

Finally, the standardized total effect (i.e., direct plus indirect effects) of age at epilepsy onset on academic achievement was .21. The direct path from age at epilepsy onset to academic achievement was not statistically significant (standardized path coefficient =  $-.03$ ,  $p = .646$ ), but the direct paths from age at epilepsy onset to neuropsychological functioning and neuropsychological functioning to academic achievement were both statistically significant (standardized path coefficients = .30,  $p < .001$  and  $.80$ ,  $p < .0001$ , respectively). Examination of the indirect path revealed that neuropsychological functioning mediated the relation between age at epilepsy onset and academic achievement (standardized indirect effect =  $.24$ ; Sobel's test statistic =  $2.86$ ,  $p < .01$ ).

*Mediation of relationship between seizure characteristics and peer difficulties.*

Hypothesis Seven asserted that neuropsychological functioning and the three behavioral/academic variables (inattentive behavior, anxious behavior, academic achievement) would each mediate the association between seizure characteristics (age at epilepsy onset, seizure status) and peer difficulties. Table 6 indicates that age at epilepsy onset was related to neuropsychological functioning, inattentive behavior, anxious behavior, academic achievement, and peer difficulties, but seizure status was only related



to inattentive behavior, anxious behavior, and peer difficulties. Thus, only inattentive behavior and anxious behavior could be examined as potential mediators between seizure status and peer difficulties.

Examining which variables mediated the relation between age at epilepsy onset and peer difficulties was performed first. The standardized total effect (i.e., direct plus indirect effects) of age at epilepsy onset on peer difficulties was  $-.26$ . The direct path from age at epilepsy onset to peer difficulties was not statistically significant (standardized path coefficient =  $-.01$ ,  $p = .886$ ). The hypothesized model (Figure 3) indicates that the relation between age at epilepsy onset and peer difficulties may be mediated by a string of variables (e.g., age at epilepsy onset  $\rightarrow$  neuropsychological functioning  $\rightarrow$  inattentive behavior  $\rightarrow$  peer difficulties). The only way to test this type of mediation is to do so in segments (i.e., age at epilepsy onset  $\rightarrow$  neuropsychological functioning  $\rightarrow$  inattentive behavior; neuropsychological functioning  $\rightarrow$  inattentive behavior  $\rightarrow$  peer difficulties), which was already conducted when testing Hypotheses Five and Six. Based on the previously reviewed analyses for Hypotheses Five and Six, it appears that the relation between age at epilepsy onset and peer difficulties is mediated by the neuropsychological functioning and inattentive behavior paths (i.e., neuropsychological functioning mediates the relation between age at epilepsy onset and inattentive behavior [standardized indirect effect =  $-.17$ ; Sobel's test statistic =  $-2.60$ ,  $p < .01$ ]; inattentive behavior mediates the relation between neuropsychological functioning and peer difficulties [standardized indirect effect =  $-.22$ ; Sobel's test statistic =  $-2.56$ ,  $p < .01$ ]) and the neuropsychological functioning and anxious behavior paths (neuropsychological functioning mediates the relation between age at epilepsy onset and

anxious behavior [standardized indirect effect =  $-.09$ ; Sobel's test statistic =  $-1.98$ ,  $p < .05$ ]; anxious behavior mediates the relation between neuropsychological functioning and peer difficulties [standardized indirect effect =  $-.16$ ; Sobel's test statistic =  $-2.26$ ,  $p < .05$ ).

In regard to seizure status, the standardized total effect of seizure status on peer difficulties was  $.21$ . The direct path from seizure status to peer difficulties was not statistically significant (standardized path coefficient =  $.02$ ,  $p = .653$ ). The direct paths from seizure status to inattentive behavior and anxious behavior were statistically significant (standardized path coefficients =  $.18$ ,  $p < .05$  and  $.23$ ,  $p < .05$ , respectively), as were the paths from inattentive and anxious behavior to peer difficulties (standardized path coefficients =  $.39$ ,  $p < .01$  and  $.54$ ,  $p < .0001$ , respectively). Examination of indirect paths revealed that inattentive behavior did not mediate the relation between seizure status and peer difficulties (standardized indirect effect =  $.07$ ; Sobel's test statistic =  $1.78$ ,  $p = .075$ ). However, anxious behavior did mediate the relation between seizure status and peer difficulties (standardized indirect effect =  $.12$ ; Sobel's test statistic =  $2.19$ ,  $p < .05$ ).

Additional analyses were performed to determine if seizure status related more strongly to either anxious behavior or inattentive behavior. Constraining the seizure status to anxious behavior and seizure status to inattentive behavior paths to be equal did not result in a significant change in model fit (change in  $\chi^2 [1] = 1.068$ ,  $p = .320$ ), which indicates that seizure status was not more strongly related to anxious behavior than it was to inattentive behavior.

*Model invariance across sex.* Hypothesis Eight asserted that the relation between anxious behavior and peer difficulties would be stronger for girls than for boys and the relation between inattentive behavior and peer difficulties would be stronger for boys than for girls. A multi-group structural equation model was tested to determine if child sex moderated the relation between inattentive behavior and peer difficulties and anxious behavior and peer difficulties. The multi-group analysis function in Amos 6.0 was used to test for variance/invariance in model parameters across both sexes. Prior to implementing the multi-group analysis function, a baseline model (i.e., the hypothesized model in Figure 3), in which all parameters were allowed to be freely estimated, was established for each sex group in order to determine if the factor structure (i.e., number and character of factors) was equivalent for boys ( $n = 88$ ) and girls ( $n = 85$ ). The initial testing of the baseline model revealed that the variance/covariance matrix was not positive definite for boys. Examination of the variance/covariance matrix in the variables in the model revealed that the peer difficulties and inattentive behavior factors were highly correlated ( $r = .94$ ). Thus, it was decided that the peer difficulties factor would be modified since this factor had more indicators than did the inattentive behavior factor. Those measures comprising the peer difficulties factor that shared method variance with measures comprising the inattentive behavior factor were targeted first (i.e., CBCL Social Problems subscale and TRF Social Problems subscale). When the CBCL Social Problems subscale was removed from the peer difficulties factor, the model demonstrated a acceptable fit to the data for boys ( $\chi^2 [114] = 120.785, p = .314; CFI = .990; RMSEA = .026$  with a 90% confidence interval of .000 to .061) and for girls ( $\chi^2 [114] = 117.018, p = .404; CFI = .995; RMSEA = .018$  with a 90% confidence interval of .000 to .059). Thus,

all subsequent multi-group analyses were conducted using the hypothesized model in Figure 3 as the baseline model, minus the CBCL Social Problems subscale, for each sex group.

After establishing the baseline model, the multi-group analysis function in Amos 6.0 was implemented to examine if the factor indicator loadings, the structural paths, and the variance of the age at epilepsy onset and seizure status variables<sup>7</sup> were equivalent across boys and girls. First, the multi-group analysis function tested the unconstrained baseline model simultaneously for both groups in order to provide fit statistics against which subsequent constrained models would be compared. As expected, the unconstrained model was a good fit ( $\chi^2 [228] = 237.803, p = .314; CFI = .993; RMSEA = .016$  with a 90% confidence interval of .000 to .036). Second, the model with all factor indicator loadings constrained equal across groups was tested and compared to the unconstrained model. Results indicated that the model showed a good fit ( $\chi^2 [239] = 254.523, p = .234; CFI = .988; RMSEA = .019$  with a 90% confidence interval of .000 to .038) and was not significantly different from the unconstrained model ( $\chi^2 [11] = 16.720, p = .116$ ), which indicates that the factor loadings were invariant across boys and girls.

Third, the model with all factor loadings and structural paths constrained equal across groups was tested and compared to the model with just the factor loadings constrained. Results revealed that this model showed a good fit ( $\chi^2 [254] = 268.809, p = .250; CFI = .989; RMSEA = .018$  with a 90% confidence interval of .000 to .037) and was not significantly different from the model with just the factor loadings constrained ( $\chi^2 [15] = 14.286, p = .504$ ), which implies that all structural paths were invariant across boys and girls. Finally, the model with all factor loadings, all structural paths, and age at

epilepsy onset and seizure status variances constrained across groups was tested and compared to the previous model with all factor loadings and structural paths constrained. Results indicated that the model showed a good fit ( $\chi^2 [256] = 269.410, p = .270$ ; CFI = .990; RMSEA = .018 with a 90% confidence interval of .000 to .036) and was not significantly different from the model with all factor loadings and structural paths constrained ( $\chi^2 [2] = .601, p = .740$ ), which indicates that the age at epilepsy onset and seizure status variances were not different across boys and girls. Because no differences in model fit were evident when constraints were placed on the structural paths across boys and girls, Hypothesis Eight was not supported.

*Additional analyses.* Additional analyses were also performed substituting selected variables in the hypothesized model with alternative variables that may also be associated with peer difficulties in children with epilepsy such as family functioning (i.e., as a proxy for parenting), aggressive behavior, and perceived stigma. A description of these analyses is in Appendix B.

## Discussion

This is the first known study to utilize a theoretical framework to examine and organize variables associated with peer difficulties in children with epilepsy. In particular, this study investigated variables posited to be related to peer difficulties in typically developing children (i.e., inattentive behavior, anxious behavior, and academic achievement) and variables hypothesized to be related to peer problems in children with epilepsy (i.e., neuropsychological functioning, age at epilepsy onset, seizure status). Using structural equation modeling, this study simultaneously examined if each of the aforementioned variables was associated with peer difficulties in children with epilepsy

and investigated possible mechanisms by which each variable related to peer difficulties and whether each relation varied by child sex.

Overall, results showed that two factors in the structural model, inattentive behavior and anxious behavior, were directly associated with peer difficulties in children with epilepsy. Likewise, epilepsy-related factors, such as neuropsychological functioning, age at epilepsy onset, and seizure status, were indirectly related to peer difficulties and directly related to inattentive behavior and anxious behavior in children with epilepsy. There were no variations in the structural model based on child sex. Study findings imply that there are likely similarities between children with epilepsy and typically developing children in regard to variables related to their peer problems and, therefore, general theoretical models of peer difficulty may be useful when examining peer problems in children with epilepsy. However, study results also suggest that epilepsy-related factors are important to consider when investigating factors associated with peer difficulties in children with the disorder. A detailed discussion of the study results will be provided in turn.

#### *Associations Among Predictor Variables and Peer Difficulties in Children with Epilepsy*

Several hypothesized relations between predictor variables and peer difficulties were supported. Hypotheses One through Four examined if the study variables were related. Findings revealed that variables theorized to be associated with peer difficulties in typically developing children, such as lower academic achievement and greater levels of anxious and inattentive behavior (Coie, 1990), were related to peer difficulties in children with epilepsy. Moreover, epilepsy-related factors such as deficits in neuropsychological functioning, earlier age at epilepsy onset, and active seizure status

were all related to peer difficulties in children with epilepsy. In addition, deficits in neuropsychological functioning were associated with higher levels of inattentive behavior, anxious behavior, lower academic achievement, and earlier age at epilepsy onset; earlier age at epilepsy onset was also related to greater levels of inattentive behavior, anxious behavior, and lower academic achievement; active seizure status was associated with higher levels of inattentive and anxious behavior.

These findings suggest that variables related to peer difficulties in typically developing children (i.e., inattentive behavior, anxious behavior, academic achievement; Bierman, 2004; Coie, 1990) and variables relevant to having epilepsy (i.e., neuropsychological functioning, age at epilepsy onset, seizure status) are associated with peer difficulties in children with epilepsy. Therefore, attending to both general and epilepsy-related factors seems essential to understanding why peer problems occur in children with the disorder.

*Inattentive Behavior, Anxious Behavior, and Academic Achievement as Mediators of the Relation between Neuropsychological Functioning and Peer Difficulties*

Hypotheses Five investigated the mechanisms by which neuropsychological functioning related to peer difficulties in children with epilepsy. Supplemental analyses also compared the strengths of the paths involved in the mediation between neuropsychological functioning and peer difficulties in order to understand each factor's relative contribution to social behavior problems and peer difficulties. As expected, the relation between neuropsychological functioning and peer difficulties was partially mediated by both inattentive and anxious behavior. Specifically, deficits in neuropsychological functioning predicted higher levels of inattentive and anxious

behavior and lower levels of academic achievement. Higher levels of anxious and inattentive behaviors then predicted greater levels of peer difficulty; however, academic achievement did not predict peer difficulties. Supplemental analyses indicated that neuropsychological functioning predicted academic achievement the strongest followed by predicting inattentive behavior and then anxious behavior less strongly, and anxious behavior predicted peer difficulties the strongest followed by inattentive behavior and then academic achievement predicting peer difficulties less strongly.

Taken together, these findings are consistent with claims that deficits in neuropsychological functioning have a negative impact on children's social functioning (Nassau & Drotar, 1997; Semrud-Clikeman & Wical, 1999). However, because the design of the current study is cross-sectional, it is difficult to ascertain the true nature of the above variable relations. The relation between neuropsychological functioning and inattentive behavior, anxious behavior, and academic achievement might be because neuropsychological deficits make children with epilepsy less able to attend during social interactions, make them feel less competent in social situations, and make it difficult for them to properly process and understand academic information, respectively. However, the difference in the magnitude of the relations between neuropsychological functioning and inattentive behavior, anxious behavior, and academic achievement suggests that neuropsychological functioning plays a more significant role in inattentive behavior and academic achievement compared to anxious behavior, possibly because inattentive behavior and academic achievement draw upon one's cognitive abilities more so than does anxious behavior. In regard to the positive associations between inattentive behavior and anxious behavior and peer problems, these relations are likely because



inattentive and anxious behaviors are aversive and undesirable to peers (Bierman, 2004). Yet, it is also possible that experiencing peer difficulties may increase anxious and inattentive behaviors in children with epilepsy. For example, previous negative experiences with their peers may make children with epilepsy feel less competent and more anxious around their peer group. Likewise, poor peer interactions may prevent children with epilepsy from learning social skills that will help them to effectively manage their inattentive behaviors. The fact that anxious behavior predicted peer difficulties more strongly than did inattentive behavior implies that anxious behavior is more robustly associated with peer relationship difficulties in children with epilepsy compared to inattentive behavior. This is inconsistent with research on typically developing children, which has shown that inattentive behavior is a stronger predictor of peer problems compared to anxious behavior (Bierman, 2004). More research on the relation between maladaptive behaviors and peer difficulties in children with epilepsy is needed to help clarify if the above finding is spurious or is something unique to epilepsy. Finally, in terms of the lack of relation between academic achievement and peer difficulties, it is probable that academic achievement does not predict peer difficulties in children with epilepsy, and the significant association between academic achievement and peer difficulties in the measurement model may have been more a function of a child's overall cognitive functioning, per se, rather than a child's academic performance.

*Neuropsychological Functioning as a Mediator of the Relations between Seizure Characteristics and Inattentive Behavior, Anxious Behavior, and Academic Achievement*

Hypothesis Six examined the potential mechanism by which seizure characteristics related to inattentive behavior, anxious behavior, and academic

achievement in children with epilepsy. Findings revealed that the relations between age at epilepsy onset and inattentive behavior, anxious behavior, and academic achievement were mediated by neuropsychological functioning. Specifically, earlier age at epilepsy onset predicted deficits in neuropsychological functioning which, in turn, predicted greater inattentive and anxious behavior and lower academic achievement. However, contrary to expectations, the relations between seizure status and inattentive and anxious behavior were not mediated by neuropsychological functioning.

These results are somewhat consistent with findings from a study by Schoenfeld et al. (1999), which indicated that earlier age at epilepsy onset was related to neuropsychological deficits and lower academic achievement, and seizure status was related to anxious and inattentive behavior in children with epilepsy. Within the present study, the association between earlier age at epilepsy onset and neuropsychological deficits may be because a more chronic course of epilepsy increases the likelihood of cognitive problems. Moreover, it is possible that active seizures were related to inattentive and anxious behaviors because seizures make children with epilepsy less able to attend during social interactions and more anxious due to fear of having a seizure in social situations. Nonetheless, given the cross-sectional nature of this study, the above causal assertions are merely speculative. It is reasonable to suspect that the relations among the epilepsy-related variables (i.e., age at epilepsy onset, seizure status, neuropsychological functioning) and social behaviors and academic achievement could all be due to a common third entity such as an underlying neuropathology.

*Neuropsychological Functioning, Inattentive Behavior, Anxious Behavior, and Academic Achievement as Mediators of the Relations Between Seizure Characteristics and Peer Difficulties*

Hypothesis Seven examined the possible mechanisms by which seizure characteristics related to peer difficulties in children with epilepsy. As anticipated, neuropsychological functioning, inattentive behavior, and anxious behavior partially mediated the relation between age at epilepsy onset and peer difficulties. In particular, earlier age at epilepsy onset predicted deficits in neuropsychological functioning, which predicted greater levels of anxious and inattentive behavior, which, in turn, predicted higher levels of peer difficulty. Moreover, inattentive and anxious behavior partially mediated the relation between seizure status and peer difficulties. Specifically, active seizure status predicted greater levels of anxious and inattentive behavior, which, in turn, predicted higher levels of peer difficulty.

These results are consistent with previous claims that having seizures may put children at risk for social behavior problems, which could therefore negatively impact their peer relations (La Greca, 1990; Nassau & Drotar, 1997). Possible explanations for the relations among the aforementioned variables were discussed previously in this section and will not be reviewed again here. Nonetheless, these results indicate that there may be multiple pathways through which seizure characteristics relate to peer difficulties. In particular, it seems that age at epilepsy onset may be associated with peer difficulties via deficits in neuropsychological functioning and behavior problems. On the other hand, seizure status appears to be associated with peer difficulties primarily via behavioral problems. These implications suggest that seizure characteristics should be examined

separately in order to fully understand the nature of their potential individual influences on peer difficulties in children with epilepsy.

#### *Examination of Child Sex as a Moderating Variable*

Finally, Hypothesis Eight investigated if inattentive behaviors were more strongly related to peer problems for boys with epilepsy compared to girls with epilepsy and if anxious behaviors were more strongly associated with peer difficulties for girls with epilepsy compared to boys with epilepsy. Interestingly, there were no differences between boys and girls in regard to which behaviors were more strongly related to their peer problems, which is contrary to findings in previous research on peer difficulties in typically developing children (Coie et al., 1990). The results were not entirely unexpected given that boys and girls in the current study did not differ on the majority of the measures that assessed inattentive and anxious behavior. The similarities between boys and girls in the present sample are inconsistent with norms on the Achenbach scales (Achenbach, 1991a, 1991b), which indicate that boys tend to exhibit greater levels of inattentive behavior compared to girls. Hence, it is possible that having epilepsy increases the risk for girls, in particular, to exhibit inattentive behavior, which could have a potential adverse effect on their peer relations. Clearly, it would be beneficial for researchers to examine potential sex similarities and differences in future studies of children with epilepsy.

#### *Model Implications*

Overall, findings from the study hypotheses imply that utilizing a developmental psychopathology framework to investigate factors associated with peer difficulties in children with epilepsy is informative. In particular, social behavior problems, which are

believed to have considerable influence on peer problems in typically developing children (Bierman, 1994; Coie, 1990), seem to be important components of the theoretical model used in the current study. Likewise, expanding the model to include neuropsychological functioning and seizure characteristic seems to be particularly important given their direct relation with social behavior problems and indirect association with peer difficulties. Interestingly, however, factors such as academic achievement and child sex did not seem to provide significant contributions to the model. In sum, this study provides a useful framework for examining factors related to peer difficulties in children with epilepsy. However, there are several study limitations, which will be reviewed in turn.

### *Limitations*

As mentioned earlier, the current study was cross-sectional in nature, so drawing definitive conclusions about whether seizure characteristics and neuropsychological functioning cause behavioral difficulties and subsequent peer problems is not possible. As mentioned previously, it is possible that some of the variable relations could be bi-directional or could be due to a common underlying third variable. Nonetheless, the relations among the variables in this study, as well as findings from previous longitudinal studies on peer difficulties in typically developing children (Coie & Kupersmidt, 1983), provide some guidance as to which variables should be examined as potential predictors of peer difficulty in future longitudinal studies of children with epilepsy. For future studies, researchers should assess epilepsy-related factors, neuropsychological functioning, social behaviors, and peer relations over the course of time in order to

determine which variables significantly predict the development of peer difficulties in children with epilepsy.

Another study limitation was that the peer difficulties construct did not contain peer report data. Within the developmental literature, peer difficulties are often assessed using peer nomination techniques, in which children's classmates or grade mates report on target children (Bierman, 2004). Because children with epilepsy are a specialized group, it is unlikely that more than one child with epilepsy would be enrolled in the same classroom or school. Thus, obtaining peer nominations for each child with epilepsy, although not impossible, would require extensive time and resources. Although the present study did not incorporate peer reports into the peer difficulties construct, it did utilize multiple reporters, including self-, parent-, and teacher-report data on the CSCS, CBCL, and TRF, respectively. Given evidence that parent ratings on the CBCL Social Problems subscale are related to peer nominations (Schwartz et al., 1999), using these reporters seemed to be a reasonable method of assessing the peer difficulties construct. Nonetheless, it may be beneficial for researchers to invest the time and resources to obtain peer nominations for future studies on peer difficulties in children with epilepsy.

A third limitation of the present study was that the anxious behavior construct was not solely comprised of anxious behavior items. This construct contained the Anxious/Depressed subscales of the CBCL and TRF and the Anxiety subscale of the CSCS. Each of these subscales have items that assess anxious and depressive behaviors, hence making the anxious behavior construct more of a general internalizing behavior construct rather than a pure anxious behavior construct. The construct was labeled anxious behavior for the present study because Coie's (1990) model identifies anxious

behavior as a potential contributor to peer problems. However, according to Coie's model, avoidant behavior, which one might consider a symptom of both anxiety and depression, is also a contributor to peer difficulties. Regardless, for future studies, researchers would benefit from obtaining more pure assessments of anxious behavior in order to conclude definitively that anxious behavior is related to peer difficulties in children with epilepsy.

A fourth limitation to the current study was sample size. The entire study sample was large enough to detect medium to large effect sizes. However, the sample size for the multi-group analyses (i.e., approximately 85 children per group) was less ideal for detecting medium to large effect sizes. As stated above, because children with epilepsy are such a specialized group, it is quite challenging to obtain a sample size large enough to detect small effects. Some of the path coefficients in the mediational analyses, such as the direct path between neuropsychological functioning and peer difficulties, may have been significant if a larger sample size had been utilized. In the future, researchers would remedy this limitation by collecting data on a larger sample of children with epilepsy, which could be accomplished by using multi-site data collection methods.

A fifth limitation of this present study was the lack of comparison group. Several previous studies found significant differences between children with epilepsy and other children on measures of peer difficulty (Rodenburg et al., 2005). Yet, the current study could not replicate these findings because it only examined children with epilepsy. For the present study, it would have been useful to establish if those variables associated with peer difficulties in children with epilepsy were also related to peer difficulties in other groups of children so that one could determine if treatment interventions for peer

difficulty should be tailored differently for each group of children. Possible comparison groups for future studies of children with epilepsy might include typically developing children, children with other non-CNS health conditions (e.g., asthma, diabetes), and children with CNS conditions other than epilepsy (e.g., cerebral palsy, traumatic brain injury, spina bifida). Using typically developing children as a comparison group would not only help provide further evidence that children with epilepsy are at greater risk for peer difficulties compared to typically developing children, but it would also help to further clarify what aspects of a general theoretical framework for peer difficulties that children with epilepsy have in common with typically developing children. Utilizing children with non-CNS health conditions as a comparison group would help to delineate if certain medical characteristics (e.g., age at condition onset) are related to peer difficulties across non-CNS condition and epilepsy groups. Likewise, having children with other CNS conditions as a comparison group may first help ascertain if children with CNS conditions are at similar risk for peer difficulties compared to children with epilepsy or if it is something about having epilepsy (i.e., unpredictable, unusual seizures) that puts affected children at greater risk for peer problems. A CNS condition comparison group may also help determine if both medical characteristics and neuropsychological functioning relate similarly to peer difficulties in children with other CNS conditions. Granted, children with chronic health conditions are a specialized group; thus, a study that included children with different health conditions would likely require multi-site data collection in order to have a large enough sample size to detect between group differences.



A final limitation was the heterogeneity of the study sample. As indicated previously, the children in the sample differed in their primary seizure type. Moreover, although the entire sample was taking medication, it is likely that each child differed in regard to the type and amount of anti-epileptic medication prescribed. To date, there is conflicting information regarding whether more severe behavioral problems in children with epilepsy are related to certain seizure types (e.g., Mendelbaum & Burack, 1997; Westbrook, Bauman, & Shinnar, 1992) or certain kinds or amounts of medications (e.g., Austin et al., 2002; Williams, Bates, et al., 1998). Nonetheless, it may behoove researchers to consider seizure type and medication variables in future studies of peer difficulties in children with epilepsy in order to determine if these variables relate to their peer problems.

In sum, researchers who conduct future studies on peer difficulties in children with epilepsy may improve upon the current study by implementing longitudinal designs that allow for the establishment of causal relations among the predictor and dependent variables as well as collecting data at multiple sites so that larger sample sizes could be obtained for both children with epilepsy and comparison groups. Moreover, devoting more resources to measuring peer difficulty using peer nomination techniques and considering the potential influence of other epilepsy-related variables (i.e., seizure type and medications) would be beneficial. Despite the above limitations, however, results from the current study provide some insight into the treatment of peer difficulties in children with epilepsy. Potential treatment options and future directions will be discussed next.

### *Treatment Implications and Future Directions*

The results of the present study indicate that anxious and inattentive behaviors are directly associated with peer difficulties in children with epilepsy. Therefore, if these behaviors, indeed, contribute to and maintain peer difficulties in children with epilepsy, they might be a good route for intervention for children with the disorder who are experiencing peer problems. Considering that maladaptive social behaviors are likely due, in part, to social-information processing deficits (Coie, 1990), employing social-cognitive skills training techniques that target how children with epilepsy encode, interpret, and respond to social information could be beneficial. Evidence indicates that this type of intervention, paired with instructing parents on how to reinforce positive behaviors and arrange exposures to social situations, have yielded improvements in social competence and peer relationships for both healthy children (McFayden-Ketchum & Dodge, 1998) and children with CNS conditions such as brain tumors (Barakat et al., 2003). Given that study results also revealed that epilepsy-related factors such as seizure status and neuropsychological deficits are related to social behavior problems in children with epilepsy, mental health professionals should modify social skills interventions, if necessary, to capitalize on relative neuropsychological strengths as well as coach children with epilepsy on how to skillfully handle peer inquiries regarding their seizures. Other helpful strategies may be to educate peers and school personnel about epilepsy and to teach children with epilepsy about treatment adherence and seizure management. Hopefully, these techniques would help children with epilepsy improve their social behaviors and peer relationships.

In regard to future directions, addressing the present study's limitations would be an important first step. Moreover, there are other variables integral to the development of peer problems (e.g., Coie, 1990) that were not explored in the present study that may be worth examining in future research. For example, it would be useful to understand better the mechanism by which neuropsychological functioning relates to social behavior difficulties. In particular, do neuropsychological deficits disrupt social-information processing, thereby negatively affecting social behaviors in children with epilepsy? Likewise, which aspects of neuropsychological functioning (i.e., executive functioning, attention, and memory) contribute to the social-information processing difficulties? In addition, do parenting attitudes toward epilepsy influence social behaviors in children with epilepsy? Exploring these variables may be crucial to further understanding why children with the disorder experience peer problems.

In addition to investigating other variables, researchers may also wish to identify if there are certain subgroups of children with epilepsy who are at particular risk for developing peer problems. For example, do some children with the disorder develop peer problems because they have frequent seizures, which therefore place them at risk for anxious behavior? Do other children with epilepsy have peer difficulties because they have neurocognitive deficits that increase their inattentive behavior? It would be beneficial to identify potential subgroups so that treatment interventions can be specialized according to each child's challenges.

### *Conclusions*

In conclusion, this study provides evidence that anxious and inattentive behaviors, as well as epilepsy-related factors such as neuropsychological deficits, earlier age at

epilepsy onset, and active seizure status, are associated with peer difficulties in children with epilepsy. These findings suggest that traditional treatments that target both maladaptive social behaviors and epilepsy-related factors may be useful for treating peer difficulties in children with the disorder. Hopefully, by implementing longitudinal study designs, obtaining peer reports, and utilizing comparison groups in future studies, mental health professionals can more fully understand the role of epilepsy-related factors and social behaviors in peer difficulties in children with epilepsy.

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Table 1

*Study Hypotheses*

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- 1) Inattentive behavior, anxious behavior, and lower academic achievement will each be associated with peer difficulties in children with epilepsy.
  - 2) Deficits in neuropsychological functioning and seizure characteristics (i.e., earlier age at onset, active seizure status) will each be related to peer problems in children with epilepsy.
  - 3) Deficits in neuropsychological functioning will be related to inattentive behavior, anxious behavior, and lower academic achievement.
  - 4) Seizure characteristics will be related to deficits in neuropsychological functioning, inattentive behavior, anxious behavior, and lower academic achievement.
  - 5) Inattentive behavior, anxious behavior, and academic achievement will each mediate the relation between neuropsychological functioning and peer problems.
  - 6) Neuropsychological functioning will mediate the relation between seizure characteristics and each of the proximal factors (i.e., inattentive behavior, anxious behavior, and academic achievement).
  - 7) Neuropsychological functioning, inattentive behavior, anxious behavior, and academic achievement will each mediate the association between seizure characteristics and peer problems.
  - 8) Anxious behavior will be associated more strongly with peer problems in girls with epilepsy; inattentive behavior will be related more strongly to peer difficulties in boys with epilepsy.
-



Table 2

*List of Measures and Raters*

Measure	Rater
Demographic form	Parent
Peer Difficulties	
CSCS Popularity subscale	Child
CBCL Social Competence subscale	Parent
CBCL Social Problems subscale	Parent
TRF Social Problems subscale	Teacher
Inattentive Behavior	
CBCL Attention Problems subscale	Parent
TRF Attention Problems subscale	Teacher
Anxious Behavior	
CSCS Anxiety subscale	Child
CBCL Anxious/Depressed subscale	Parent
TRF Anxious/Depressed subscale	Teacher

(table continues)

Table 2 continued

*List of Measures and Raters*

Measure	Rater
Academic Achievement	
WJR Reading Cluster score	Child <sup>a</sup>
Mathematics Cluster score	Child <sup>a</sup>
Writing Cluster score	Child <sup>a</sup>
Neuropsychological Functioning	
WRAML Story Memory subscale	Child <sup>a</sup>
WRAML Design Memory subscale	Child <sup>a</sup>
WRAML Verbal Learning subscale	Child <sup>a</sup>
CPT Hit Reaction Time Standard Error (Hit RTSE)	Child <sup>a</sup>
Children's Category Test (CCT)	Child <sup>a</sup>
IQ	
K-BIT Vocabulary subtest	Child <sup>a</sup>
K-BIT Matrices subtest	Child <sup>a</sup>

(table continues)

Table 2 continued

*List of Measures and Raters*

Measure	Rater
Seizure Characteristics	
Age at epilepsy onset (years)	Parent/Medical records
Seizure status (i.e., active or controlled)	Parent/Medical records

*Note.* CSCS = Piers-Harris Children's Self-Concept Scale, CBCL = Child Behavior Checklist, TRF = Teacher Report Form, WJR = Woodcock-Johnson Psychoeducational Battery – Revised, WRAML = Wide Range Assessment of Memory and Learning, CPT = Conners' Continuous Performance Test, and K-BIT = Kaufman Brief Intelligence Test. <sup>a</sup>Scores on these measures were obtained from a structured assessment of the child in a neuropsychological testing laboratory.

Table 3  
*Descriptive Statistics for Continuous Variables*

Measure	<i>n</i>	<i>M</i>	<i>SD</i>	Range	Skew	Items	Alpha
CSCS Popularity subscale <sup>a</sup>	166	7.8	2.9	1-12	-.53	12	.77
CSCS Anxiety subscale <sup>a</sup>	166	9.4	3.3	1-14	-.46	14	.79
CBCL Social Competence subscale <sup>a</sup>	168	5.4	2.1	0-11	.13	4	--
CBCL Social Problems subscale <sup>a</sup>	170	5.0	3.4	0-14	.70	8	.74
CBCL Attention Problems subscale <sup>a</sup>	170	8.5	4.8	0-20	.18	11	.83
CBCL Anxious/Depressed subscale <sup>a</sup>	170	6.5	5.0	0-23	.90	14	.86
TRF Social Problems subscale <sup>a</sup>	162	4.3	4.9	0-24	1.58	13	.87
TRF Attention Problems subscale <sup>a</sup>	162	13.3	10.3	0-37	.34	20	.95
TRF Anxious/Depressed subscale <sup>a</sup>	162	5.1	5.2	0-26	1.58	18	.86
WJR Reading Cluster score <sup>b</sup>	164	92.7	17.5	39-132	-.51	--	--
WJR Mathematics Cluster score <sup>b</sup>	164	92.9	20.6	37-136	-.46	--	--

(table continues)

Table 3 continued

*Descriptive Statistics for Continuous Variables*

Measure	<i>n</i>	<i>M</i>	<i>SD</i>	Range	Skew	Items	Alpha
WJR Writing Cluster score <sup>b</sup>	159	84.0	16.4	23-122	-.71	--	--
WRAML Story Memory subscale <sup>c</sup>	164	8.0	3.7	1-15	-.03	--	--
WRAML Design Memory subscale <sup>c</sup>	164	7.4	3.2	1-16	.05	--	--
WRAML Verbal Learning subscale <sup>c</sup>	164	9.6	3.6	1-19	-.07	--	--
CPT Hit RTSE <sup>d</sup>	163	72.9	17.1	33-114	.20	--	--
CCT <sup>d</sup>	164	45.7	9.8	21-72	-.08	--	--
K-BIT Vocabulary subtest <sup>b</sup>	165	91.3	14.5	42-123	-.58	--	--
K-BIT Matrices subtest <sup>b</sup>	165	96.3	15.6	51-129	-.29	--	--
Age at epilepsy onset (years)	173	6.0	3.7	0-14.4	.15	--	--

*Note.* CSCS = Piers-Harris Children's Self-Concept Scale, CBCL = Child Behavior Checklist, TRF = Teacher Report Form, WJR = Woodcock-Johnson Psychoeducational Battery – Revised, WRAML = Wide Range Assessment of Memory and Learning, CPT = Conners' Continuous Performance Test, CCT = Children's Category Test, and K-BIT = Kaufman Brief Intelligence Test. <sup>a</sup>Raw score. <sup>b</sup>Standard score. <sup>c</sup>Scaled score. <sup>d</sup>T score.

Table 4

*Bi-variate Relations Among Study Measures*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
1) CSCS Popularity subscale	---	72 <sup>◊</sup>	22 <sup>†</sup>	-40 <sup>◊</sup>	-39 <sup>◊</sup>	-40 <sup>◊</sup>	-40 <sup>◊</sup>	-36 <sup>◊</sup>	-31 <sup>◊</sup>	26 <sup>^</sup>	19 <sup>*</sup>	24 <sup>†</sup>	19 <sup>*</sup>	12	27 <sup>◊</sup>	-25 <sup>†</sup>	20 <sup>*</sup>	17 <sup>*</sup>	18	19	20
2) CSCS Anxiety subscale	---	---	22 <sup>†</sup>	-39 <sup>◊</sup>	-28 <sup>◊</sup>	-39 <sup>◊</sup>	-25 <sup>†</sup>	-22 <sup>†</sup>	-31 <sup>◊</sup>	24 <sup>†</sup>	20 <sup>*</sup>	18 <sup>*</sup>	13	12	20 <sup>*</sup>	-23 <sup>†</sup>	21 <sup>†</sup>	18 <sup>*</sup>	12	19 <sup>†</sup>	19 <sup>†</sup>
3) CBCL Social Comp. subscale	---	---	---	-41 <sup>◊</sup>	-36 <sup>◊</sup>	-30 <sup>◊</sup>	-36 <sup>◊</sup>	-31 <sup>◊</sup>	-28 <sup>◊</sup>	23 <sup>†</sup>	20 <sup>*</sup>	21 <sup>†</sup>	22 <sup>†</sup>	17 <sup>*</sup>	14	-06	11	32 <sup>◊</sup>	17 <sup>*</sup>	09	09
4) CBCL Social Problems subscale	---	---	---	---	72 <sup>◊</sup>	66 <sup>◊</sup>	46 <sup>◊</sup>	37 <sup>◊</sup>	35 <sup>◊</sup>	-36 <sup>◊</sup>	-31 <sup>◊</sup>	-31 <sup>◊</sup>	-25 <sup>†</sup>	-18 <sup>*</sup>	-29 <sup>◊</sup>	20 <sup>†</sup>	19 <sup>*</sup>	-31 <sup>◊</sup>	-24 <sup>†</sup>	-11	-11
5) CBCL Attention Problems subscale	---	---	---	---	---	64 <sup>◊</sup>	42 <sup>◊</sup>	48 <sup>◊</sup>	32 <sup>◊</sup>	-33 <sup>◊</sup>	-31 <sup>◊</sup>	-33 <sup>◊</sup>	-23 <sup>†</sup>	-16 <sup>*</sup>	-33 <sup>◊</sup>	19 <sup>*</sup>	-16 <sup>*</sup>	-25 <sup>†</sup>	-24 <sup>†</sup>	-11	-11

(table continues)

Table 4 continued

*Bi-variate Relations Among Study Measures*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
6) CBCL Anxious/Depressed subscale						---	31 <sup>◊</sup>	24 <sup>†</sup>	36 <sup>◊</sup>	-10	-08	-11	-05	-08	-11	09	-03	-01	-02	-00
7) TRF Social Problems subscale							---	68 <sup>◊</sup>	76 <sup>◊</sup>	-21 <sup>†</sup>	-15	-19*	-28 <sup>†</sup>	-20*	-39 <sup>◊</sup>	22 <sup>†</sup>	-14	-19*	-13	-24 <sup>†</sup>
8) TRF Attention Problems subscale								---	45 <sup>◊</sup>	-29 <sup>◊</sup>	-28 <sup>◊</sup>	-33 <sup>◊</sup>	-28 <sup>◊</sup>	-22 <sup>†</sup>	-46 <sup>◊</sup>	35 <sup>◊</sup>	-17*	-26 <sup>^</sup>	-31 <sup>◊</sup>	-23 <sup>†</sup>
9) TRF Anxious/Depressed subscale									---	-08	-03	-07	-16*	-11	-19*	11	-15	-03	-05	-17*
10) WJR Reading Cluster score										---	80 <sup>◊</sup>	85 <sup>◊</sup>	57 <sup>◊</sup>	33 <sup>◊</sup>	56 <sup>◊</sup>	-34 <sup>◊</sup>	37 <sup>◊</sup>	77 <sup>◊</sup>	66 <sup>◊</sup>	23 <sup>†</sup>

(table continues)

Table 4 continued

*Bi-variate Relations Among Study Measures*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
11) WJR Math Cluster score											---	78 <sup>o</sup>	51 <sup>o</sup>	35 <sup>o</sup>	55 <sup>o</sup>	-36 <sup>o</sup>	50 <sup>o</sup>	68 <sup>o</sup>	71 <sup>o</sup>	15
12) WJR Writing Cluster score												---	54 <sup>o</sup>	28 <sup>o</sup>	55 <sup>o</sup>	-40 <sup>o</sup>	31 <sup>o</sup>	68 <sup>o</sup>	65 <sup>o</sup>	15
13) WRAML Story Memory subscale													---	41 <sup>o</sup>	52 <sup>o</sup>	-25 <sup>o</sup>	27 <sup>o</sup>	58 <sup>o</sup>	49 <sup>o</sup>	25 <sup>o</sup>
14) WRAML Design Memory subscale														---	49 <sup>o</sup>	-27 <sup>o</sup>	21 <sup>o</sup>	37 <sup>o</sup>	39 <sup>o</sup>	14

(table continues)



Table 4 continued

*Bi-variate Relations Among Study Measures*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
15)																					
WRAML																					
Verbal																					
Learning																					
subscale																					
16) CPT																					
Hit RTSE																					
17) CCT																					
18) K-BIT																					
Vocabulary																					
subtest																					
19) K-BIT																					
Matrices																					
subtest																					

(table continues)

Table 4 continued

*Bi-variate Relations Among Study Measures*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
20) Age at epilepsy onset																					---
Active seizures																					
<i>M</i>	7.6	9.2	5.3	5.4*	9.1 <sup>†</sup>	7.1 <sup>†</sup>	4.8 <sup>†</sup>	14.1	5.7*	92.0	93.0	82.6	7.7	7.2	9.4	73.0	46.4	90.8	96.5	6.0	
<i>SD</i>	3.0	3.3	2.2	3.3	4.6	5.0	5.0	10.5	5.5	17.9	21.1	17.0	3.6	3.1	3.5	17.0	10.1	14.7	15.9	3.7	
Controlled seizures																					
<i>M</i>	8.4	9.7	5.8	4.0*	6.9 <sup>†</sup>	4.7 <sup>†</sup>	2.9 <sup>†</sup>	11.1	3.7*	94.3	93.0	87.0	8.7	7.8	10.2	72.5	44.3	92.5	95.6	5.9	
<i>SD</i>	2.8	3.2	1.9	3.1	4.8	4.4	3.5	9.4	4.4	16.5	19.7	14.7	3.9	3.3	3.8	17.6	9.0	14.0	14.9	3.8	

*Note.* Decimals in the correlation matrix are omitted. CSCS = Piers-Harris Children's Self-Concept Scale, CBCL = Child Behavior Checklist, TRF = Teacher Report Form, WJR = Woodcock-Johnson Psychoeducational Battery – Revised, WRAML = Wide Range Assessment of Memory and Learning, CPT = Conners' Continuous Performance Test, CCT = Children's Category Test, and K-BIT = Kaufman Brief Intelligence Test.

◇  $p \leq .0001$ , ^  $p \leq .001$ , †  $p \leq .01$ , \*  $p \leq .05$ .

Table 5

*Bi-variate Relations Among Study Measures and Parent Education Level, Child Age, Child Sex, and Child Race*

Measure	Parent Education Level ( <i>r</i> )	Child Age ( <i>r</i> )	Child Sex ( <i>M</i> [ <i>SD</i> ])		Child Race ( <i>M</i> [ <i>SD</i> ])	
			M	F	White	Other
			CSCS Popularity subscale	.07	.16*	8.2 (3.0)
CSCS Anxiety subscale	.03	.06	10.5 <sup>◇</sup> (2.8)	8.3 <sup>◇</sup> (3.4)	9.3 (3.3)	10.1 (3.6)
CBCL Social Competence subscale	.15	-.02	5.7 (2.2)	5.2 (2.0)	5.5 (2.1)	4.7 (2.3)
CBCL Social Problems subscale	-.09	-.11	4.7 (3.1)	5.5 (3.6)	5.0 (3.4)	5.2 (3.6)
CBCL Attention Problems subscale	-.10	-.14	8.6 (4.8)	8.5 (4.8)	8.5 (4.7)	8.9 (5.5)
CBCL Anxious/Depressed subscale	-.11	-.19*	6.3 (5.1)	6.7 (5.0)	6.4 (4.9)	7.1 (6.6)
TRF Social Problems subscale	.06	-.19*	4.5 (4.5)	4.1 (5.2)	4.5 (5.0)	2.5 (3.4)
TRF Attention Problems subscale	-.01	-.34 <sup>◇</sup>	14.7 (10.9)	11.9 (9.5)	13.6 (10.2)	10.4 (10.8)
TRF Anxious/Depressed subscale	.06	-.14	4.9 (5.3)	5.3 (5.2)	5.2 (5.3)	4.0 (3.7)
WJR Reading Cluster score	.12	-.01	91.8 (18.2)	93.7 (16.7)	92.8 (17.8)	92.7 (13.5)

(table continues)

Table 5 continued

*Bi-variate Relations Among Study Measures and Parent Education Level, Child Age, Child Sex, and Child Race*

Measure	Parent Education Level ( <i>r</i> )	Child Age ( <i>r</i> )	Child Sex		Child Race	
			<i>(M[SD])</i>		<i>(M[SD])</i>	
			M	F	White	Other
WJR Mathematics Cluster score	.05	.04	92.6 (22.2)	93.4 (19.0)	93.4 (21.0)	88.2 (15.4)
WJR Writing Cluster score	.16*	.10	81.4* (16.3)	86.7* (16.0)	84.3 (16.5)	80.4 (14.6)
WRAML Story Memory subscale	.10	.04	7.5* (3.6)	8.6* (3.7)	8.1 (3.7)	7.6 (3.6)
WRAML Design Memory subscale	-.07	.16*	7.2 (3.3)	7.5 (3.1)	7.4 (3.2)	7.0 (3.0)
WRAML Verbal Learning subscale	-.03	.19*	9.3 (3.9)	10.0 (3.3)	9.6 (3.6)	10.1 (4.4)
CPT Hit RTSE	-.11	-.27 <sup>^</sup>	71.9 (15.5)	74.0 (18.7)	73.2 (17.1)	69.2 (17.3)
CCT	.02	.05	47.0 (10.3)	44.5 (9.1)	45.6 (9.8)	47.4 (9.2)
K-BIT Vocabulary subtest	.11	-.10	91.3 (14.6)	91.4 (14.5)	91.8 (14.4)	86.6 (15.6)
K-BIT Matrices subtest	.08	-.01	95.9 (16.5)	96.6 (14.7)	96.2 (15.6)	96.7 (15.8)
Age at epilepsy onset (years)	-.06	.16*	6.2 (3.6)	5.8 (3.8)	5.8* (3.7)	8.0* (3.5)

(table continues)

Table 5 continued

*Bi-variate Relations Among Study Measures and Parent Education Level, Child Age, Child Sex, and Child Race*

Measure	Parent Education Level <i>M(SD)</i>	Child Age <i>M(SD)</i>	Child Sex		Child Race	
			<i>n</i>		<i>n</i>	
			M	F	White	Other
Active seizures	13.6 (2.2)	11.7 (1.9)	61	57	105	13
Controlled seizures	13.5 (2.4)	11.8 (1.8)	26	27	51	2

*Note.* CSCS = Piers-Harris Children's Self-Concept Scale, CBCL = Child Behavior Checklist, TRF = Teacher Report Form, WJR = Woodcock-Johnson Psychoeducational Battery – Revised, WRAML = Wide Range Assessment of Memory and Learning, CPT = Conners' Continuous Performance Test, CCT = Children's Category Test, and K-BIT = Kaufman Brief Intelligence Test.

<sup>◇</sup>  $p \leq .0001$ , <sup>^</sup>  $p \leq .001$ , <sup>†</sup>  $p \leq .01$ , \*  $p \leq .05$ .

Table 6

*Measurement Model: Intercorrelations Among Latent and Manifest Variables and Standardized Loadings of Directly Measured Variables on Latent Variables*

Variables	Latent					Manifest	
	1	2	3	4	5	6	7
1) Peer Difficulties	---	.86 <sup>◇</sup>	.86 <sup>◇</sup>	-.43 <sup>◇</sup>	-.54 <sup>◇</sup>	-.26 <sup>†</sup>	.21*
2) Inattentive Behavior		---	.68 <sup>◇</sup>	-.50 <sup>◇</sup>	-.59 <sup>◇</sup>	-.26 <sup>†</sup>	.18*
3) Anxious Behavior			---	-.25*	-.33 <sup>†</sup>	-.20*	.23*
4) Academic Achievement				---	.79 <sup>◇</sup>	.21 <sup>†</sup>	---
5) Neuropsychological Functioning					---	.30 <sup>†</sup>	---
6) Age at Epilepsy Onset						---	---
7) Seizure Status							---
Measured Variables	1	2	3	4	5	6	7
CSCS Popularity	-.56 <sup>◇</sup>						
CBCL Social Competence	-.51 <sup>◇</sup>						
CBCL Social Problems	.71 <sup>◇</sup>						
TRF Social Problems	.69 <sup>◇</sup>						
CBCL Attention Problems		.72 <sup>◇</sup>					
TRF Attention Problems		.70 <sup>◇</sup>					
CSCS Anxiety			-.55 <sup>◇</sup>				
CBCL Anxious/Depressed			.62 <sup>◇</sup>				
TRF Anxious/Depressed			.62 <sup>◇</sup>				
WJR Reading Cluster				.93 <sup>◇</sup>			
WJR Mathematics Cluster				.86 <sup>◇</sup>			
WJR Writing Cluster				.91 <sup>◇</sup>			
WRAML Story Memory					-.69 <sup>◇</sup>		
WRAML Design Memory					.54 <sup>◇</sup>		
WRAML Verbal Learning					.81 <sup>◇</sup>		
CPT Hit RTSE					-.50 <sup>◇</sup>		
CCT					.46 <sup>◇</sup>		

*Note.* CSCS = Piers-Harris Children's Self-Concept Scale, CBCL = Child Behavior Checklist, TRF = Teacher Report Form, WJR = Woodcock-Johnson Psychoeducational Battery – Revised, WRAML = Wide Range Assessment of Memory and Learning, CPT = Conners' Continuous Performance Test, CCT = Children's Category Test.

<sup>◇</sup>  $p \leq .0001$ , <sup>†</sup>  $p \leq .01$ , \*  $p \leq .05$ .

Table 7

*Measurement Model with IQ Factor: Intercorrelations Among Latent and Manifest Variables and Standardized Loadings of Directly Measured Variables on Latent Variables*

Variables	Latent					Manifest	
	1	2	3	4	5	6	7
1) Peer Difficulties	---	.85 <sup>◇</sup>	.86 <sup>◇</sup>	-.45 <sup>◇</sup>	-.44 <sup>◇</sup>	-.25 <sup>†</sup>	.23 <sup>†</sup>
2) Inattentive Behavior		---	.69 <sup>◇</sup>	-.50 <sup>◇</sup>	-.49 <sup>◇</sup>	-.26 <sup>†</sup>	.24*
3) Anxious Behavior			---	-.26*	-.22*	-.19	.20*
4) Academic Achievement				---	.96 <sup>◇</sup>	.23 <sup>†</sup>	---
5) IQ					---	.22*	---
6) Age at Epilepsy Onset						---	---
7) Seizure Status							---
Measured Variables	1	2	3	4	5	6	7
CSCS Popularity	-.55 <sup>◇</sup>						
CBCL Social Competence	-.53 <sup>◇</sup>						
CBCL Social Problems	.74 <sup>◇</sup>						
TRF Social Problems	.65 <sup>◇</sup>						
CBCL Attention Problems		.75 <sup>◇</sup>					
TRF Attention Problems		.67 <sup>◇</sup>					
CSCS Anxiety			-.55 <sup>◇</sup>				
CBCL Anxious/Depressed			.65 <sup>◇</sup>				
TRF Anxious/Depressed			.60 <sup>◇</sup>				
WJR Reading Cluster				.95 <sup>◇</sup>			
WJR Mathematics Cluster				.85 <sup>◇</sup>			
WJR Writing Cluster				.89 <sup>◇</sup>			
K-BIT Vocabulary					.84 <sup>◇</sup>		
K-BIT Matrices					.74 <sup>◇</sup>		

*Note.* CSCS = Piers-Harris Children's Self-Concept Scale, CBCL = Child Behavior Checklist, TRF = Teacher Report Form, WJR = Woodcock-Johnson Psychoeducational Battery – Revised, WRAML = Wide Range Assessment of Memory and Learning, CPT = Conners' Continuous Performance Test, CCT = Children's Category Test.

<sup>◇</sup>  $p \leq .0001$ , <sup>†</sup>  $p \leq .01$ , \*  $p \leq .05$ .

## Footnotes

<sup>1</sup>A child is diagnosed with having epilepsy if he or she has had two or more unprovoked seizures, which is determined based on clinical description and specific abnormalities on an electroencephalogram (EEG). However, a child can be diagnosed with epilepsy solely by clinical signs and symptoms, even if an EEG does not indicate abnormal brain wave activity (Epilepsy Foundation, 2005).

Children with epilepsy can have more than one type of seizure. There are several epilepsy syndromes characterized by certain seizure types and prognoses. A more extensive discussion of these syndromes can be found in Williams and Sharp (2000). A seizure is classified as either primary generalized or partial (Epilepsy Foundation, 2005; Thompson & Trimble, 1996). Primary generalized seizures involve electrical epileptic discharges in both hemispheres of the brain, have an abrupt onset, and usually create a sudden loss of consciousness. They include convulsive seizures (i.e., loss of consciousness followed by tonic [stiffening] and/or clonic [jerking] movements of the trunk and/or extremities), absence seizures (i.e., brief staring episodes involving sudden cessation of activity and momentary loss of consciousness), atonic seizures (i.e., extremely abrupt loss of muscle tone that produce a sudden fall), and myoclonic seizures (i.e., brief, single, symmetrical jerks of the head and upper extremities that occur in a series or cluster). Partial seizures involve electrical epileptic discharges in a localized region of the brain and are frequently preceded by an aura or warning (e.g., strange feeling of fear, nausea, foul odor or taste, dizziness, *déjà vu*). The clinical presentation of the aura and seizure typically reflect the function of the neurons involved. They include simple partial seizures, which do not result in a loss of consciousness, and complex



partial seizures, which cause an alteration of consciousness, during which the child may appear confused and exhibit automatisms (e.g., lip smacking, facial grimacing, mumbling, picking at clothing). It is possible for both simple and complex partial seizures to spread from the local region to involve both hemispheres of the brain, resulting in a secondary generalized convulsion (Epilepsy Foundation, 2005; Thompson & Trimble, 1996; Williams & Sharp, 2000).

The course of epilepsy is highly variable and depends on the seizure type, syndrome, and underlying brain pathology (Thompson & Trimble, 1996). Seizures are controlled in approximately 70-80% of children who are treated with antiepileptic medications (i.e., AEDs). There is a slightly higher mortality rate for children with epilepsy compared to children in the general population. Experiencing status epilepticus (i.e., a seizure or many short seizures lasting over 30 minutes) poses a higher risk, but mortality is usually due to underlying brain pathology rather than the prolonged seizure activity (Thompson & Trimble, 1996; Williams & Sharp, 2000).

Approximately 70% of children with epilepsy have idiopathic or cryptogenic epilepsy, whereby the cause of their seizures cannot be identified (Epilepsy Foundation, 2005). Of the remaining 30%, who have symptomatic epilepsy, the etiology of the seizures is evident and may include structural brain abnormalities, birth anoxia, cerebrovascular insults, central nervous system infections, brain tumors, or moderate to severe head trauma (Williams & Sharp, 2000). Therefore, a portion of children with epilepsy have a co-morbid neurological condition. To limit the influence of co-morbidity, this study examines children with epilepsy who have no other known health conditions and no diagnosis of mental retardation.

<sup>2</sup>To date, the literature has not definitively established the best way to determine an appropriate sample size for structural equation modeling. Prior to conducting the analyses for the current study, several steps were taken to determine if a sample size of 173 would be sufficient to test the path coefficients in the latent constructs as well as overall model fit. The first step was to determine if the sample size would be large enough to yield a stable factor structure for the measurement model given the number of hypothesized latent constructs and the number of hypothesized indicators per construct. According to Guadagnoli and Velicer (1988), the stronger the indicator loadings onto the latent construct, the less sample size is important. They posit that a sample size of at least 300 is necessary for loadings of .40 or less and fewer than four indicators per construct. On the contrary, if a researcher anticipates loadings of at least .60 and has a minimum of four indicators per construct, a sample size of 150 should be sufficient. For the present study, loadings were expected to be at least .60 per construct. Moreover, there are at least three to four indicators for most factors in the model.

In regard to testing both the measurement and structural model together, some researchers (Hair, Anderson, Tatham, & Black, 1998) claim that the minimum sample size for testing the model should be more than the number of unique variances/covariances in the input data matrix. The main SEM in the present study has 19 indicators, which requires 190 participants (e.g.,  $[19 \text{ indicators} \times 20]/2 = 190$  variance/covariances). However, Hair et al. state that certain goodness of fit indicators, such as maximum likelihood estimation, become increasingly sensitive to detecting differences between the hypothesized model and the observed data as sample size increases ( $N > 200$ ), which heightens the risk of detecting almost any discrepancies

between the two models. Therefore, Hair and colleagues suggest that a sample size between 100 to 200 subjects is ideal for models that are not overly large or complex.

In conjunction with the above information, Loehlin (1998) states that, based on the RMSEA fit statistic, the probability of rejecting a poor fit given the model is actually a good fit in the population is based on the sample size and degrees of freedom (i.e., number of unique variance/covariances in data matrix minus number of parameter estimates). For the current study, the degrees of freedom for the main SEM was 129 (209 unique variance/covariances – 80 parameters), which, according to Loehlin, warrants a sample size of at least 64 to have an 80 percent probability of rejecting a poor fit given that the model is actually a good fit. Finally, in regard to testing individual path coefficients in the model, Allan (2002) states that paths in a mediated SEM that have medium to large effect sizes require 100 and 50 subjects, respectively, in order to have an acceptable probability (.80) of being detected. Paths of .13 and .26 are considered medium and large effects, respectively. Findings from the current study indicate that many of the path coefficients in the model reflect large effects (e.g., .57 between neuropsychological functioning and attention problems). A Monte Carlo study that was conducted using *Mplus* (Múthen & Múthen, 2002) prior to beginning the analyses for the present study indicated that, based on a sample size of 170, the probability of detecting large effects (i.e., .30) for each of the path coefficients in the hypothesized model ranged from .89 to .99 (one path had a probability of .79). Given all the above information, a sample size of 173 was adequate for the present study.

<sup>3</sup>Children with active seizures and children with controlled seizures also did not differ on duration of epilepsy in years (i.e., child's date of assessment minus child's date

of epilepsy diagnosis;  $M[SD]$  for active group = 5.66 [4.00],  $M[SD]$  for controlled group = 5.91 [3.62];  $t = .390$ ,  $p = .700$ ). This implies that the active seizure group was not disproportionately comprised of children who had recently been diagnosed with epilepsy and had not yet achieved seizure management.

<sup>4</sup>The use of FIML to manage incomplete data does not allow for the computation of modification indices in Amos 6.0. Hence, the author contacted SPSS tech support to determine how to obtain modification indices. SPSS tech support recommended the use of the SPSS Missing Value Analysis (MVA) procedure to provide an estimate of the variance/covariance matrix for the variables in the measurement and structural models. The MVA procedure uses the EM algorithm to manage missing data. Using a special syntax command, the resulting variance/covariance matrix can then be transformed from an SPSS output file to an SPSS data file and read into Amos 6.0. After seeking approval from a statistical consultant knowledgeable in structural equation modeling (P. Wood, personal communication, February 2005), the procedure just described was performed solely to obtain modification indices for each of the models tested in the present study.

<sup>5</sup>Because no single measure of fit is considered ideal (Loehlin, 1998), a number of fit indices were used for testing the overall fit of the measurement and structural models. Specifically, comparative fit index (CFI), chi-square values, and root-mean square error of approximation (RMSEA) were examined. The CFI is considered a good indicator because it avoids underestimating fit in small samples; values of .90 or greater reflect a good fit (Schumacker & Lomax, 2004). The chi-square test is interpreted with caution since larger sample sizes yield a higher probability of detecting differences between the hypothesized model and observed data (Loehlin, 1998). The RMSEA values are

considered relatively insensitive to sample size. They are computed from the residual covariance matrix values; a RMSEA of .05 or lower indicates a “good” fit and values of .08 or less are considered “acceptable” (Loehlin, 1998).

<sup>6</sup>The hypothesized model was also tested with those items shared in the CBCL, TRF, and CSCS subscales removed. The measurement model with the revised subscales was a very good fit to the data ( $\chi^2 [127] = 127.561, p = .469; CFI = 1.000; RMSEA = .005$  with a 90% confidence interval of .000 to .038), and so was the structural model ( $\chi^2 [129] = 127.606, p = .518; CFI = 1.000; RMSEA = .000$  with a 90% confidence interval of .000 to .036). Both the MM and SEM yielded similar path coefficients to those path coefficients in the hypothesized model with the original subscales. Although the MM and SEM models with the shared items excluded were a better fit to the data, it was decided that the model with the original subscales would be used for the study analyses because the subscales were normed with the shared items included, and the results would be generalizable.

<sup>7</sup>Only the variances of age at epilepsy onset and seizure status variables were constrained to be equal across groups because only the variances of exogenous (i.e., independent) variables are parameters to be estimated in SEM (Raykov & Marcoulides, 2000). The variances of endogenous (i.e., dependent) variables are not constrained because they are not estimated parameters; rather, their variances are determined by other parameters in the model.

## Figure Captions

*Figure 1.* Depiction of Coie's model of peer difficulties.

*Figure 2.* Hypothesized model of peer difficulties in children with epilepsy.

*Figure 3.* Revised hypothesized model with seizure characteristics as two manifest variables.

*Note.* Paths between seizure status and age at epilepsy onset, neuropsychological functioning, and academic achievement are not included because bi-variate analyses indicated that seizure status was not related to these variables.

*Figure 4.* Structural model with standardized path coefficients.

*Note.* Dotted paths are non-significant; solid paths are significant. Error and residual terms are not shown.

$\diamond p \leq .0001, ^\wedge p \leq .001, ^\dagger p \leq .01, * p \leq .05.$

*Figure 5.* Structural model with IQ factor and standardized path coefficients.

*Note.* Dotted paths are non-significant; solid paths are significant. Error and residual terms are not shown. Paths between seizure status and age at epilepsy onset, IQ, and academic achievement are not included because bi-variate analyses indicated that seizure status was not related to these variables.

$\diamond p \leq .0001, * p \leq .05.$

*Figure 6.* Structural model with child age and standardized path coefficients.

*Note.* Dotted paths are non-significant; solid paths are significant. Error and residual terms are not shown. Paths between seizure status and age at epilepsy onset, child age, neuropsychological functioning, and academic achievement are not included because bi-variate analyses indicated that seizure status was not related to these variables. The path

between child age and academic achievement was not included because bi-variate analyses indicated that these variables were not related.

$\diamond p \leq .0001, \dagger p \leq .01, * p \leq .05.$

*Figure D1.* Structural model with aggressive behavior and standardized path coefficients.

*Note.* Dotted paths are non-significant; solid paths are significant. Error and residual terms are not shown. Paths between seizure status and age at epilepsy onset, seizure status and neuropsychological functioning, and age at epilepsy onset and aggressive behavior are not included because bi-variate analyses indicated that these variables were not related.

$\diamond p \leq .0001, \dagger p \leq .01, * p \leq .05.$

*Figure D2.* Structural model with perceived stigma and standardized path coefficients.

*Note.* Dotted paths are non-significant; solid paths are significant. Error and residual terms are not shown. Paths between seizure status and age at epilepsy onset, neuropsychological functioning, and perceived stigma are not included because bi-variate analyses indicated that seizure status was not related to these variables.

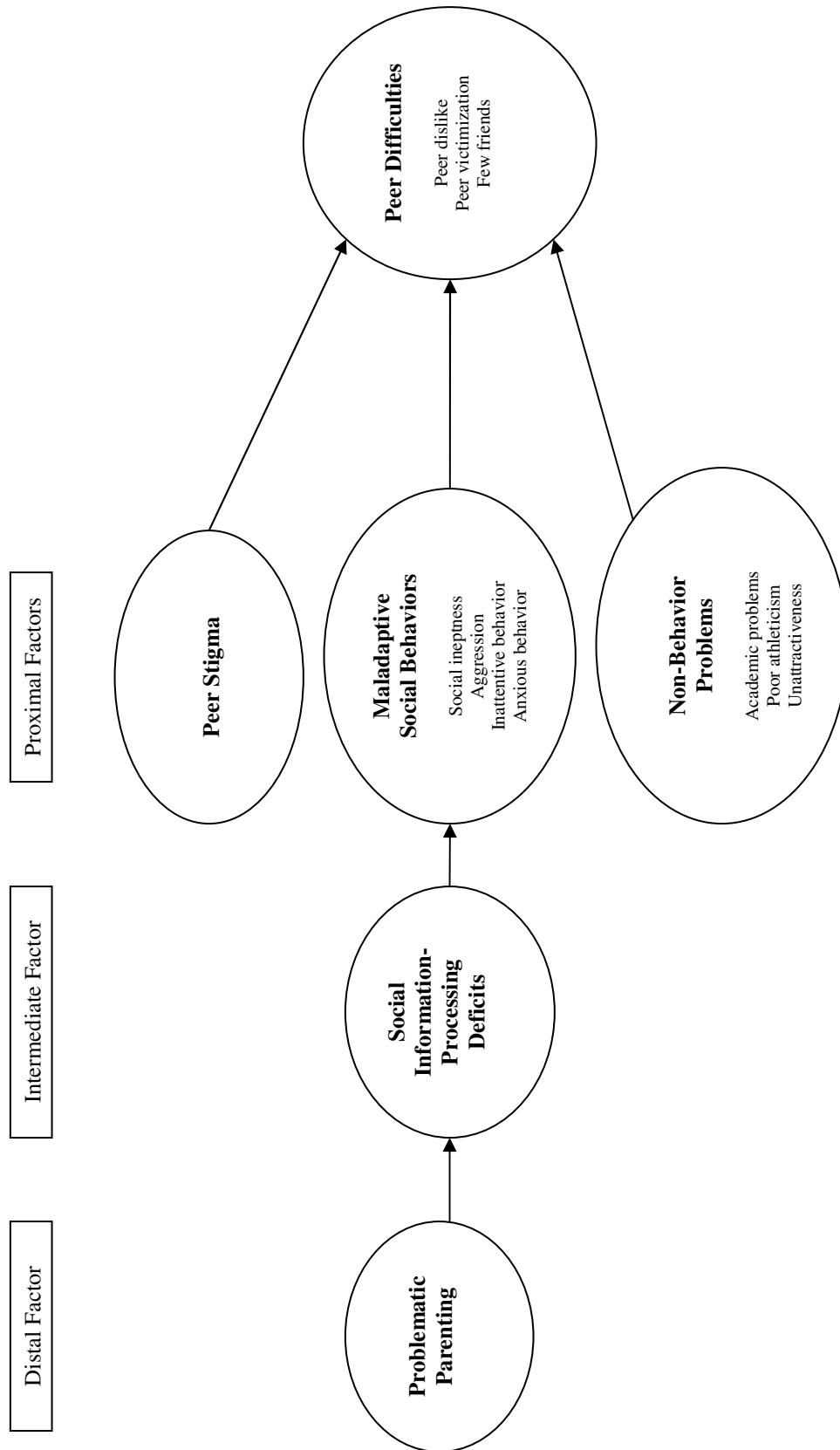
$\diamond p \leq .0001, \dagger p \leq .01, * p \leq .05.$

*Figure D3.* Structural model with family functioning and standardized path coefficients.

*Note.* Dotted paths are non-significant; solid paths are significant. Error and residual terms are not shown. Paths between seizure status and age at epilepsy onset, seizure status and neuropsychological functioning, age at epilepsy onset and family functioning, and neuropsychological functioning and family functioning are not included because bi-variate analyses indicated that these variables were not related.

$\diamond p \leq .0001, \dagger p \leq .01, * p \leq .05.$

Figure 1





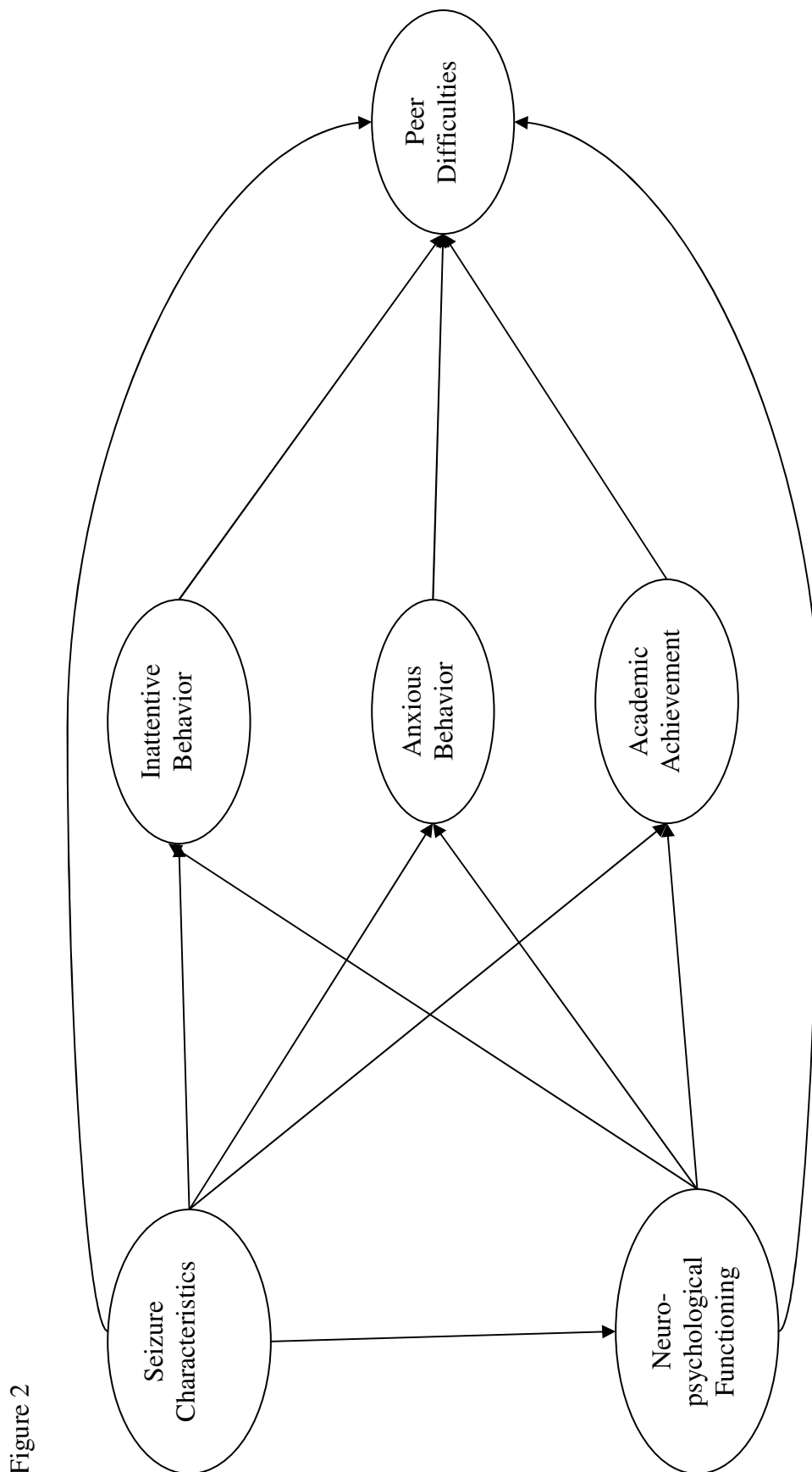
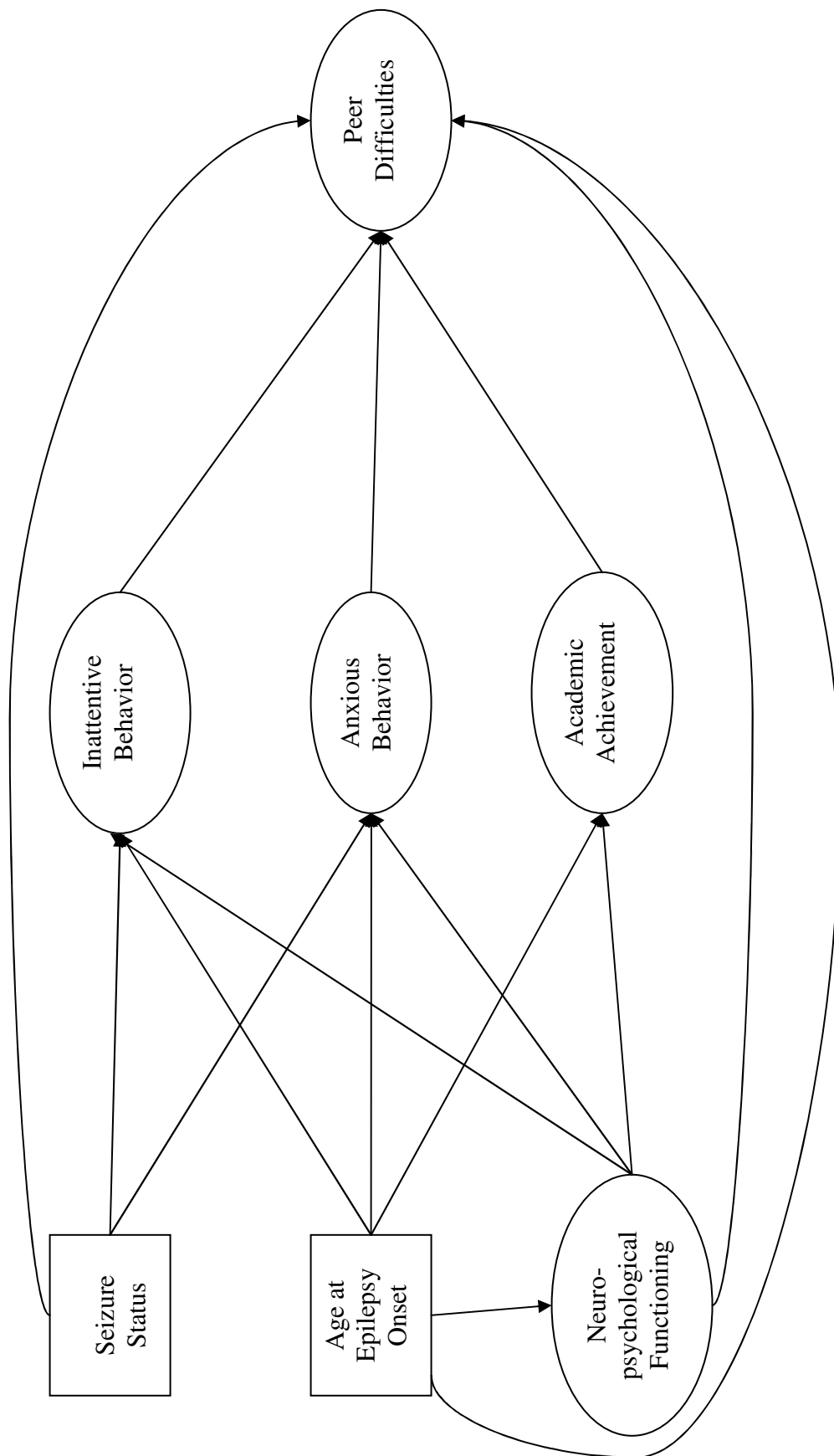


Figure 2

Figure 3



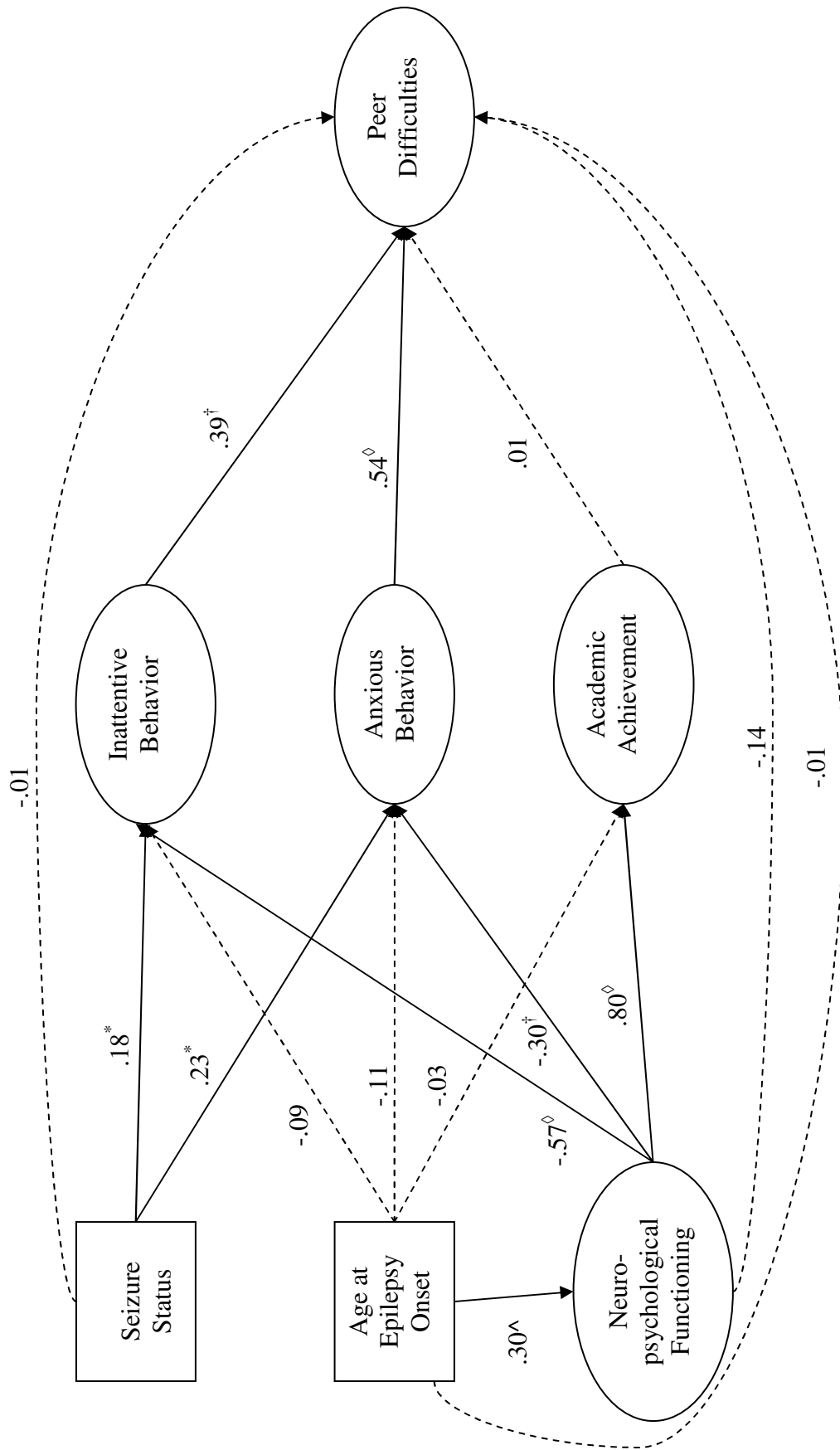


Figure 4

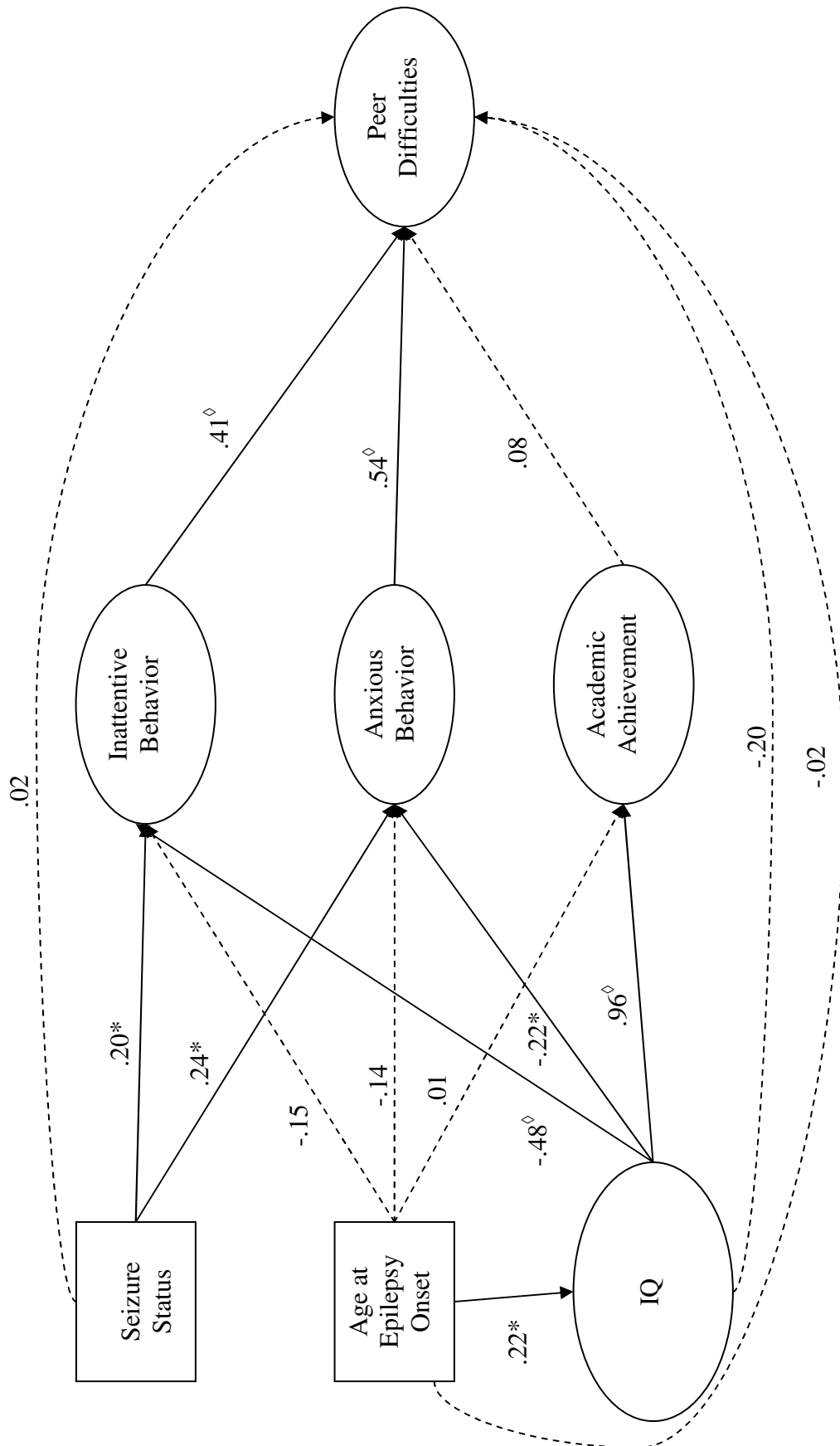
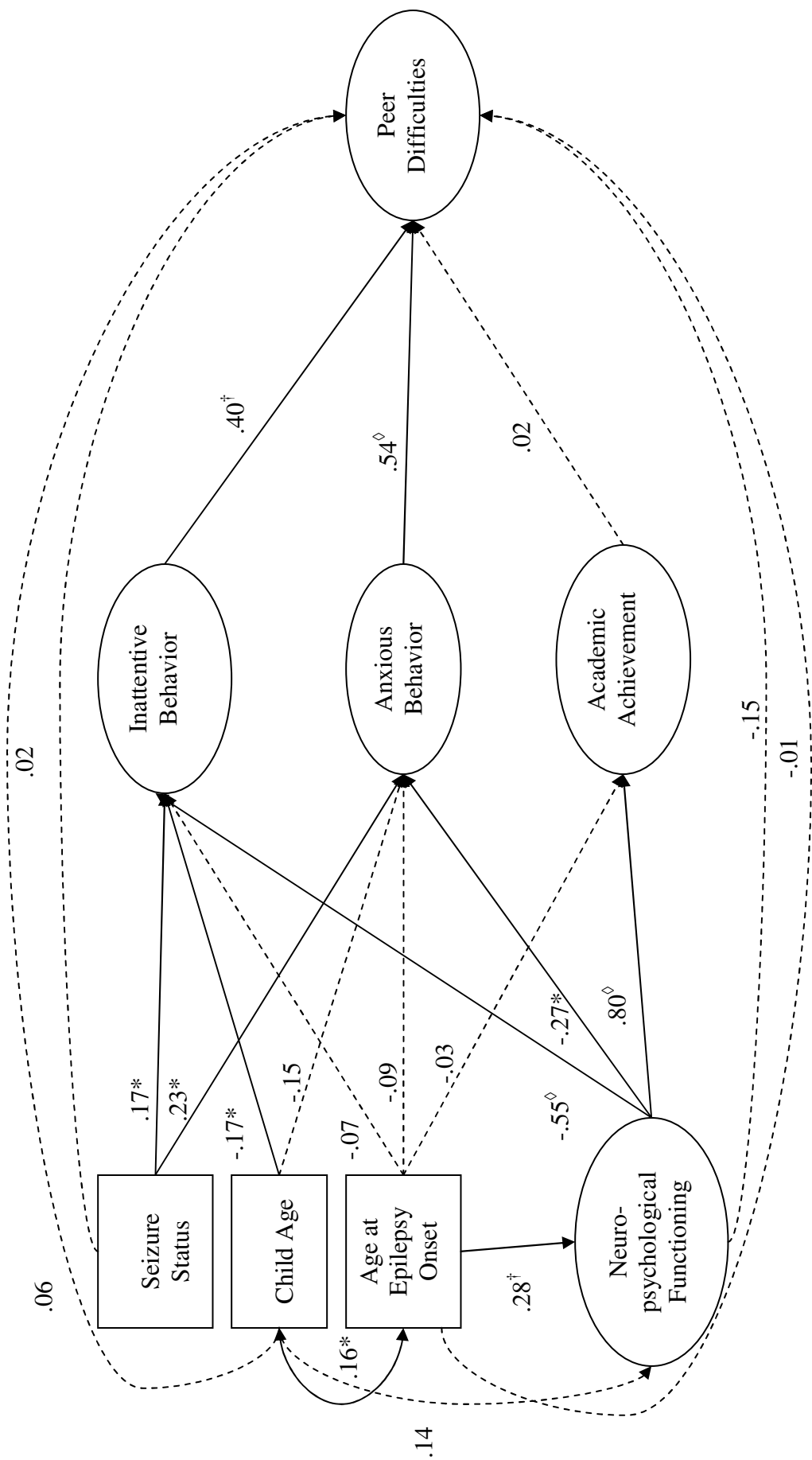


Figure 5

Figure 6



## Appendix A

### Youth Outcomes Research Program

#### BASELINE DEMOGRAPHICS / FACE PAGE

Family Number: \_\_\_\_\_ Visit: Baseline

Interview Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Child's Last Name: \_\_\_\_\_

Address: \_\_\_\_\_ apt # \_\_\_\_\_  
street

\_\_\_\_\_ city \_\_\_\_\_ state \_\_\_\_\_ zip

Phone: \_\_\_\_\_ (home) \_\_\_\_\_ (alternative)

Who lives in the household:

Name	Relation To Child	DOB	Sex (F/M)	Race	Years of Education or current grade	Study Participant (M/C)	Living in House (Y/N)
_____	_____	__/__/__	_____	_____	_____	_____	_____
_____	_____	__/__/__	_____	_____	_____	_____	_____
_____	_____	__/__/__	_____	_____	_____	_____	_____
_____	_____	__/__/__	_____	_____	_____	_____	_____
_____	_____	__/__/__	_____	_____	_____	_____	_____
_____	_____	__/__/__	_____	_____	_____	_____	_____
_____	_____	__/__/__	_____	_____	_____	_____	_____

Study Participant: M = Mother/ primary care provider C = Child

Code Relationship to Child as follows:

M = Mother SM = Step-Mother GM = Grandmother A = Aunt S = Sibling SE = Self  
 O = Other F = Father SF = Step-Father GF = Grandfather U = Uncle C = Cousin  
 HS = Half-Sibling



Additional Teacher: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_  
street city state zip

Child's School: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_  
street city state zip

Has your child had psychological/ educational testing for learning or other  
problems IN THE PAST YEAR? YES NO

IF YES, Tested By: \_\_\_\_\_

When: \_\_\_\_/\_\_\_\_/\_\_\_\_

Purpose of Testing: \_\_\_\_\_

Name / Address / Phone Number of Persons to Contact for YOUR New Address  
and/or Phone Number in the Event of a Change:

Contact 1: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_  
street city state zip

Contact 2: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_  
street city state zip

---

NOTES:

\_\_\_\_\_  
\_\_\_\_\_

Reason, if dropping out of the study: \_\_\_\_\_



Occupation / Income:

Is there a primary earner currently employed? Yes    No

If yes, what is his/her current occupation?.. \_\_\_\_\_  
 (If no, what is the longest position he/she ever held)

Thinking of all the persons who live in your house, which category is closest to your household income last year? (Include things such as SSI, Child Support, Alimony, Unemployment and/or Disability Compensation, and money coming in from investments.)

Total family income in past year before taxes: \_\_\_\_\_

- |                     |                     |
|---------------------|---------------------|
| 1 = \$ 0 - 9,999    | 6 = 50,000 - 59,999 |
| 2 = 10,000 - 19,999 | 7 = 60,000 - 69,999 |
| 3 = 20,000 - 29,999 | 8 = 70,000 - 79,999 |
| 4 = 30,000 - 39,999 | 9 = 80,000 or More  |
| 5 = 40,000 - 49,999 |                     |

In addition to income, do you receive help from any of the following:

- |                               |                                       |
|-------------------------------|---------------------------------------|
| _____ Welfare, including AFDC | _____ Public Housing (Section 8/ HUD) |
| _____ Food Stamps             | _____ WIC                             |
| _____ MEDICAID or MEDICARE    | _____ Child Support                   |

## Appendix B

Supplemental analyses were performed to determine if other variables contained in the existing dataset were associated with peer difficulties in children with epilepsy. Variables examined were aggressive behavior, perceived stigma (i.e., stigmatization from peers and people, in general), and family functioning. Based on current literature, all three variables may play a role in children's social functioning (Coie, 1990). Aggressive behavior, stigma, and family dysfunction were not central to the current study because few, if any, research studies indicate that children with epilepsy have considerable problems with these variables.

Aggressive behavior was assessed using parent and teacher ratings on the CBCL and TRF Aggressive Behavior subscales, respectively (Achenbach, 1991a, 1991b) and child ratings on the CSCS Behavior subscale (Piers, 1984). Perceived stigma was assessed using child self-report on the Child Perceptions Scale (Austin, MacLeod, Dunn, Shen, & Perkins, 2004), and family functioning was assessed using the Mastery and Communication subscales of the Family Inventory of Resources for Management measure (FIRM; McCubbin, Thompson, & McCubbin, 1996).

To include these variables in the structural model, the academic achievement factor was removed because it was not related to peer difficulties. Figure D1 is the structural model with the aggressive behavior factor included. This model demonstrates good fit ( $\chi^2 [120] = 135.151, p = .163$ ; CFI = .988; RMSEA = .027 with a 90% confidence interval of .000 to .048). Figure D2 is the structural model with the perceived stigma variable included. This model is a very good fit ( $\chi^2 [97] = 97.286, p = .473$ ; CFI = 1.000; RMSEA = .004 with a 90% confidence interval of .000 to .041). Figure D3 is the

structural model with the family functioning factor included. This model also is a good fit ( $\chi^2 [112] = 123.877, p = .209; CFI = .988; RMSEA = .025$  with a 90% confidence interval of .000 to .047). Given that all three models demonstrate a good fit to the data, each of them may serve as an alternate theoretical model to the hypothesized model examined in the current study. However, just like with academic achievement, none of the substituted variables were directly related to peer difficulties in children with epilepsy. Of particular interest is the significant relation between seizure status and family functioning and the non-significant relation between seizure status and the inattentive and anxious behavior factors (see Figure D3). These relations imply that family functioning may partially mediate the relation between seizure status and the behavior factors and, therefore, family functioning may be another mechanism by which seizure status relates to behavior problems in children with epilepsy.

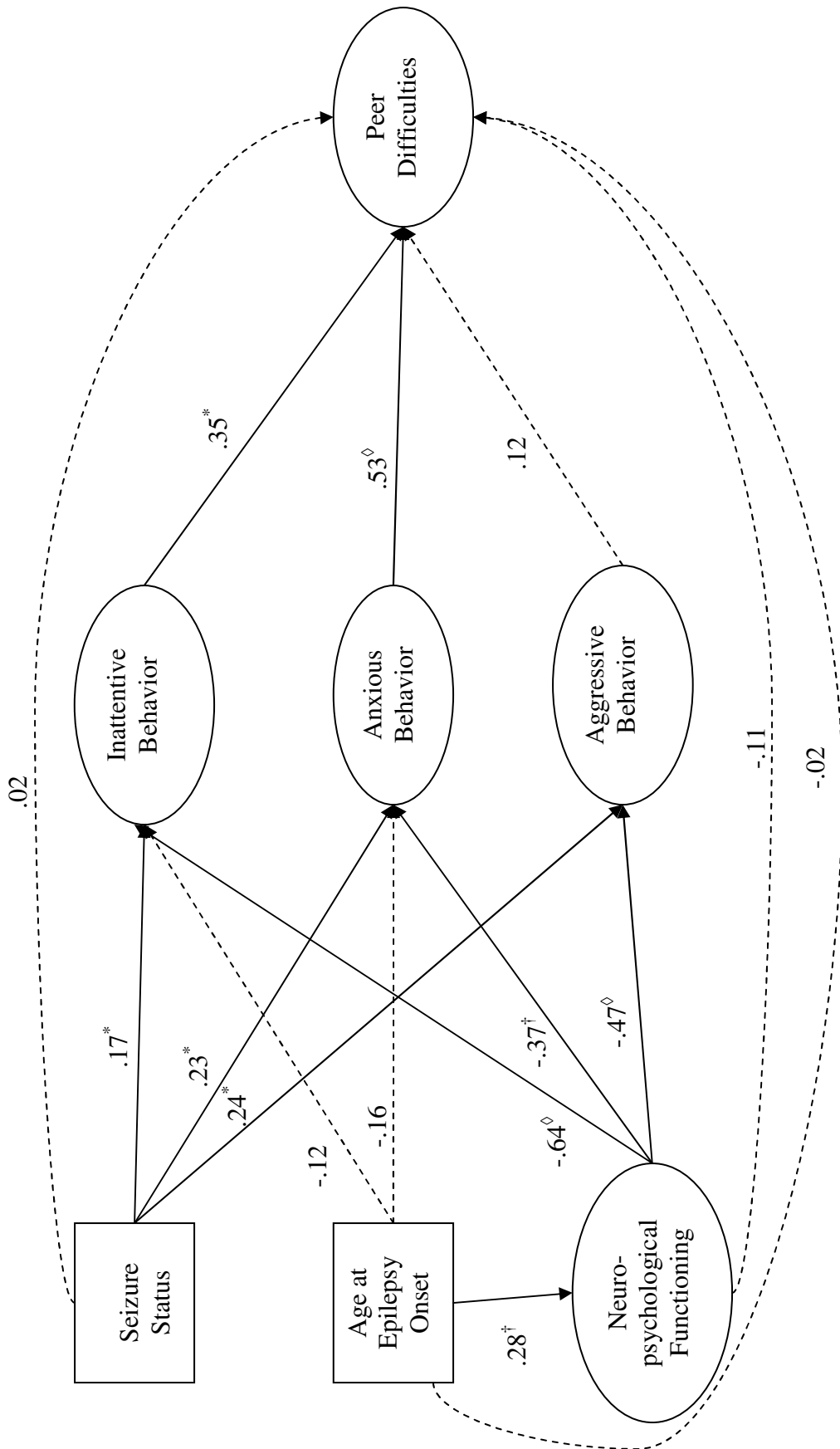


Figure D1

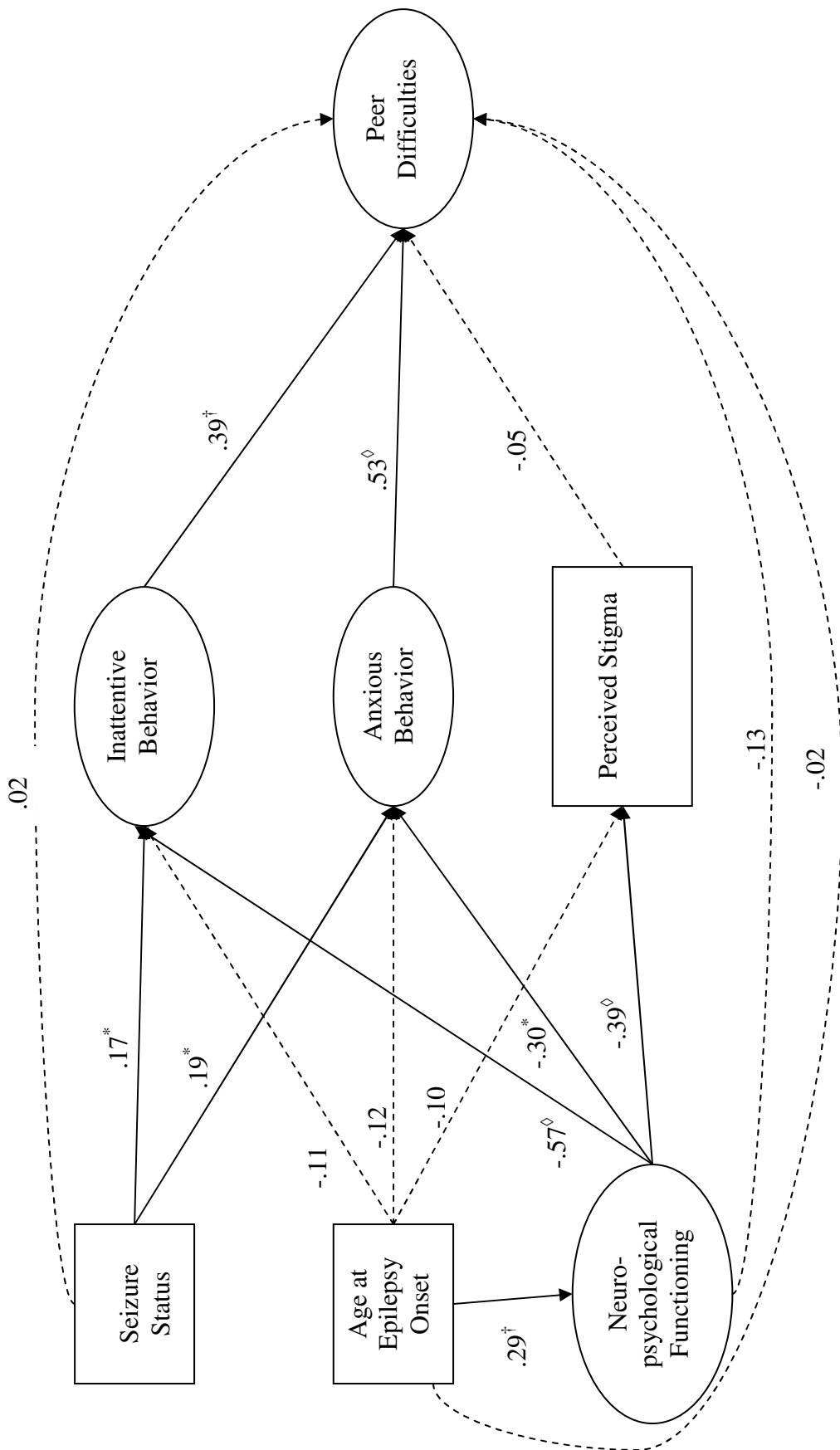


Figure D2

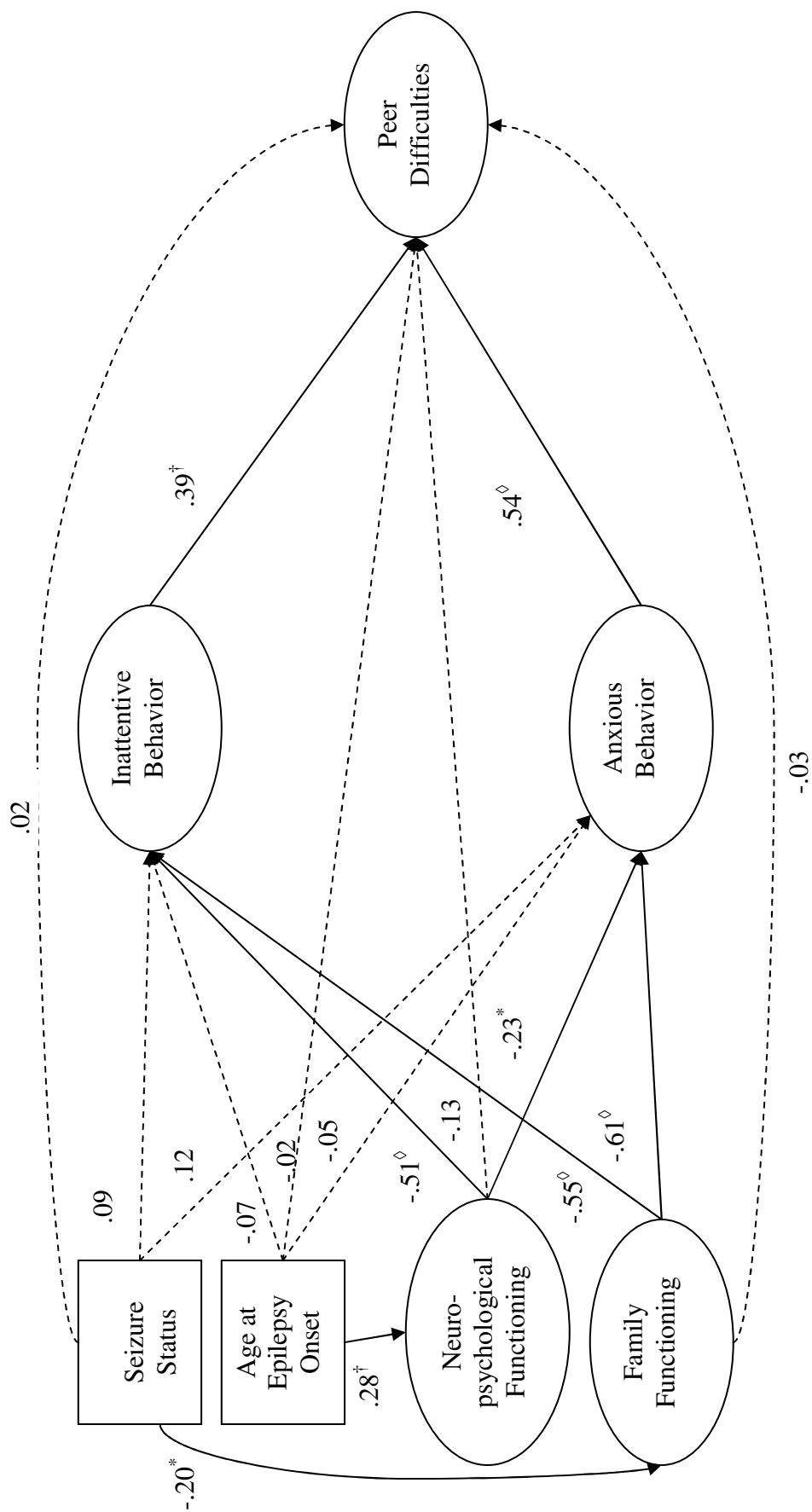


Figure D3

## VITA

Elena Theresa Harlan Drewel was born in Fullerton, California and moved to Englewood, Colorado at five years of age. After graduating from Cherry Creek High School in 1993, she attended the University of Iowa where she earned a B.S. in Psychology and a minor in Spanish in 1997. Ms. Drewel then enrolled at the University of Missouri-Columbia where she received an M.A. in Clinical Child Psychology in 2002. She is currently completing a clinical internship at the University of California-Los Angeles Semel Institute for Neuroscience and Human Behavior as a final requirement for earning her Ph.D. in Clinical Child Psychology from the University of Missouri-Columbia. Ms. Drewel is married to Scott Drewel of Springfield, Missouri.