CLASSIFICATION AND DIAGNOSIS OF CHILDREN

by

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(Under the Direction of Randy Kamphaus)

ABSTRACT

Although not currently the case, improving classification and diagnostic systems based on scientific evidence should be a priority for the field of psychology. There is growing evidence that current classification methods are not consistent with current empirical knowledge of childhood psychopathology. The objectives of this review are to provide an overview of the current status of classification and diagnosis in children and to identify areas for future research. The advantages and shortcomings of current psychiatric, dimensional, and person-oriented classification systems are examined. Future research needs are outlined, including: systems that better account for etiology, direct comparisons among classification systems, use of taxometric methods, and determining optimal classification methods for specific circumstances. Preliminary support for person-oriented, multivariate methods of classification is presented.

INDEX WORDS: Classification, Diagnosis, Person-oriented, Psychopathology

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CHAPTER 1

INTRODUCTION AND REVIEW OF LITERATURE

CLASSIFICATION AND DIAGNOSIS OF CHILDHOOD PSYCHOPATHOLOGY: CURRENT STATUS AND RESEARCH AGENDA

Purposes for Classification

Classification serves many scientific and clinical objectives. A primary purpose for classification is enhanced communication among a variety of professionals (Blashfield, 1998; Scotti & Morris, 2000). Classification allows for a common nomenclature, or a shared set of terms, which enables clinicians and researchers the ability to easily discuss and share information. This, in turn, facilitates research and clinical practice (Clark, Watson, & Reynolds, 1995).

Secondly, classification systems allow for an organizational system surrounding the common nomenclature, which aids in the retrieval of information. Specifically, researchers and clinicians can retrieve information for the purpose of interpretation of information, clinical decision-making, and statistical reporting (Scotti & Morris, 2000).

A third purpose of classification is to provide a description of a patient's cluster of symptoms (Blashfield, 1998). Individuals are classified, or placed into groups, based on their similarities. Classification, therefore, indicates that patients with similar diagnoses should have similar symptom profiles (Lorr, 1966) and past characteristics (Kagan, 1997). Patients with similar diagnoses would also be readily distinguishable from patients with differing diagnoses (Everitt, 1974).

The use of classification systems should also provide insight into the identification of risk or adjustment status (Kagan, 1997). Namely, with a certain diagnosis it should be possible to predict the course of the disorder and track individual developmental pathways (Richters, 1997). Classification should aid in the prediction of effective treatment approaches and interventions (Lewczyk, et al., 2003; Scotti & Morris, 2000), lead to a better understanding of the symptoms and causes of disorders, and allow for the differentiation of individuals by etiology (Cantwell,

1996). The implication is that classification should help guide research and practice for the prevention and treatment of disorders and serve as a concept formation system that may be used to develop theories of psychopathology (Blashfield, 1998).

A final practical use of classification systems involves financial reimbursement for services. Managed care organizations frequently only provide payment for services for those cases in which formal diagnoses are made, and commonly base their amount of allowable services dependent on the severity of the disorder and the need for services (Scotti & Morris, 2000). Hence, by classifying individuals providers can receive reimbursement for the services they render.

Ease of communication, retrieval of information, description of symptomology, identifying risk or adjustment, tracking pathways, differentiating individuals by etiology, and financial reimbursement each indicate the pressing need for accurate classification models. However, many different, and sometimes overlapping and/or competing, models of classification are currently in use. Specifically, psychiatric, dimensional, and person-oriented models of classification have all been introduced in an attempt to accurately classify mental illness.

Psychiatric Methods of Classification

Psychiatric classification models seek to place disorders into discrete categories and are characteristic of The Diagnostic and Statistical Manual of Mental Disorders (DSM, American Psychiatric Association). The DSM-IV was published in 1994 and is currently the most widely used method of psychiatric classification in the United States (Beutler & Malik, 2002). The first DSM was published in 1952 by the American Psychiatric Association (APA) and included three main categories of psychopathology: mental deficiency, functional disorders, and organic brain symptoms. In 1968, the DSM was revised to include 11 major diagnostic categories (DSM-II)

and in 1980 the third edition introduced a multi-axial system, the inclusion of explicit criteria, and removed unsubstantiated theoretical inferences. The DSM-III-R emphasized empirical literature and the DSM-IV continued with this emphasis on empirical findings (Scotti & Morris, 2000). The DSM-IV reportedly made modest improvements in the reliability and validity of several diagnostic categories, but reliability estimates for many disorders of childhood and adolescence remain in question (Nathan & Langenbucher, 1999).

The DSM-IV is recognized to be a categorical, or taxonomic, system of classification (Arend, Lavigne, Rosenbaum, Binns, & Christoffel, 1996) and is concerned with classifying mental disorders – significant distress, functional impairment, and/or special risk (House, 1999). This approach uses rules to determine membership in a category. Using these rules, disorders are seen as being either present or absent (Blashfield, 1998).

Advantages of Psychiatric Methods of Classification

There are several strengths to using a categorical system, such as the system used in the DSM. The impact of operational diagnostic criteria in the DSM-IV has made it possible to increase diagnostic agreement and improve reporting on comorbidity, services, treatment, and outcomes. Additionally, it allows for the introduction of rigorous diagnostic standards in research, provides an international reference system, and improves communication among consumers, health providers, and the public (Jablensky, 1999). Parsimony is another key strength of the DSM (Kamphaus, 2003). This system of diagnosis provides a clear, concise description of disorders and the widespread use and familiarity with the DSM allows for ease of communication among professionals for consistent research and treatment development (Blashfield, 1998).

Disadvantages of Psychiatric Methods of Classification

According to the DSM-IV-TR (APA, 1994), categorical classification is most appropriate when all members of a diagnostic class are homogeneous, when the different classes are mutually exclusive, and when the boundaries between classes are clear. However, these criteria are not met when using the DSM as a classification tool. Individuals with the same diagnosis are likely to be heterogeneous, the boundaries between classes might be difficult to determine, and different diagnoses are not completely exclusive (APA, 1994). There seems to be a lack of "goodness of fit" between current categorical classification systems and "clinical reality" (Jablensky, 1999), as verified by empirical findings.

First, comorbidity is not well accounted for in psychiatric classification systems. There are a large number of individuals, at least one-third of current cases in the general population, who meet diagnostic criteria for more than one disorder (Wittchen, 1996). In fact, epidemiological surveys indicate that more than half of the individuals with one DSM diagnosis have at least one additional disorder (Clark, Watson & Reynolds, 1995). This lends credence to the view that psychiatric illness either tends to occur in clusters, or that this current classification system fails to discriminate between disorders (Jablensky, 1999). In the anxiety and depression literature, for example, the high rate of comorbidity (up to 65 percent; DSM-IV) between the two disorders gives rise to the theory that they emanate from a "common nosological stream" (Chorpita, Plummer, & Moffit, 2000). Comorbidity seems to be the rule, rather than an exception (Sroufe, 1997) and psychiatric systems of classification are not designed for this co-occurrence of disorders. These systems that do not adequately account for comorbidity further impede research attempts to study particular categories of behavior.

Second, psychiatric classification systems fail to account for severity of symptoms, or quantitative differences among individuals with the same core symptoms (Kamphaus & Frick, 2002). Research suggests that there are quantitative differences in symptomatology for numerous behavior and emotional disorders of childhood. Specifically, evidence demonstrates quantitative differences in symptoms of hyperactivity/impulsivity, attention problems, conduct problems, depression, and anxiety (Deater-Deckard, Reiss, Hetherington, & Plomin, 1997; Fergusson & Horwood, 1995; Hudziak, Heath, Madden, Reich, Bucholz, Slutske, Bierut, et al., 1998; Hudziak, Wadsworth, Heath, & Achenbach, 1999; Neuman, Todd, Heath, Reich, Hudziak, Bucholz, Madden, Begleiter, Porjesz, Kuperman, Hesselbrock, & Reich, 1999; Scahill, Schwab-Stone, Merikangas, Leckman, Zhang, & Kasl, 1999; Nease, Volk, & Cass, 1999). For example, Hudziak, et al., (1999) tested whether attention problems in 2,100 children were continuously distributed or categorically discrete and found that symptoms of inattention should be considered as continuously distributed. A similar study by Hudziak, et al., (1998) found continuously distributed symptoms of inattention, hyperactivity, and the combination of the two in a sample of adolescent female twins.

Quantitative differences have also been found in symptoms of mood and anxiety disorders. A study by Nease, Volk, and Cass (1999) investigated the symptom severity of mood and anxiety symptoms and compared the degree of congruence with current DSM classification. This study suggested that individuals grouped by symptom severity, rather than type of symptom, (as is done in the DSM) significantly explained differences in quality of life, independent of DSM diagnosis. The authors suggested that severity should be accounted for in classification models (Nease, Volk, & Cass, 1999).

Third, this inattention to severity indicates that categorical systems of classification are also not appropriate for classifying subsyndromal psychopathology (Cantwell, 1996). Scahill, et al., (1999) studied the psychosocial and clinical correlates of ADHD in a community sample of 449 children and found that symptom severity was associated with higher levels of psychosocial severity. Additionally, they found that children beneath the diagnostic threshold for ADHD still possessed evidence of functional impairment in school that was nearly identical to the impairment levels found in children above the diagnostic threshold (Scahill, et al., 1999). Furthermore, results from a study by Hudziak et al., (1999) indicate that imposing the structure of the DSM, or a categorical system, on symptoms that are quantitatively distributed might not identify children with significant problems. These results point to the limitations of purely categorical systems of classification that could fail to classify, or diagnose, children that will nevertheless experience functional impairment due to the use of arbitrary diagnostic thresholds.

Fourth, psychiatric classification systems do not account for normally functioning or marginally functional behavioral systems. This leads to difficulty in researching phenomena such as healthy behavioral adjustment (Jensen, Watanabe, Richters, & Roper, 1996), variations in normality, the transitions between health and disease, and the endogenous and exogenous variables that affect these transitions (Rutter & Sroufe, 2000). The study of adaptive behavior and range of behaviors are also precluded by use of a categorical classification system.

Fifth, atypical disorders, such as those frequently diagnosed as “not otherwise specified” or “other,” point to the shortcomings of current psychiatric classification systems (Jablensky, 1999). The discrete nature of categorical classification does not account for individuals who do not meet specific diagnostic criteria or who meet criteria for “not otherwise specified” disorders. Heterogeneity within categories and within individuals that display mixed symptom patterns

challenge the utility and validity of the categorical approach to classification (Clark, Watson, & Reynolds, 1995). Clinical trials of classifications suggest that there is an unsatisfactory match between the diagnostic criteria and the actual features in 18-22% of cases (Regier, 1994).

A final limitation of psychiatric classification systems is its reliance on clinical judgment. Most all DSM-IV diagnoses rely entirely or primarily on objective tests or signs and depend on the clinician's ability to elicit information (Jablensky, 1999). Research indicates that reliance on clinical judgment for classification purposes is inferior to purely actuarial methods (Grove & Meehl, 1996; Dawes, Faust, & Meehl, 1989; Achenbach, 1995). Clinicians are subjected to numerous biases when they engage in diagnostic decision-making, including: a tendency to refute disconfirming evidence, determining diagnoses before collecting all relevant data, and assigning a familiar diagnosis (Lewczyk, Garland, Hurlburt, Gearity, & Hough, 2003).

These studies highlight the growing concern that categorical classification methods, while convenient and parsimonious, inadequately represent current empirical knowledge and are insufficient to serve new research needs (Helzer & Hudziak, 2000). The categorical model of classification is based on the assumption that disorders form discrete categories. This premise contributes to a "fallacious belief that psychopathological processes constitute discrete entities, even medical diseases, when in fact they are merely concepts that help focus and coordinate our observations" (Millon, 1991). Such overarching problems with categorical classification have been cited as factors in hindering research in psychopathology (Arend, et al., 1996).

Dimensional Methods of Classification

The dimensional approach to classification assumes that behavior does not occur dichotomously, but rather along a continuum. Descriptive variables such as symptoms, behaviors, and/or scales from a rating scale are collected and combined with other correlated

variables to form a dimension. Thus, the dimension summarizes information about the descriptive variables into an abstract, higher-order variable (Blashfield, 1998). There are a smaller number of dimensions than descriptive variables that should account for much of the systematic reliable variance that would be present if using the larger number of variables (Blashfield, 1998). A major assumption of this dimensional model is that individuals can exist anywhere along these dimensions (Scotti & Morris, 2000). Dimensional models classify individuals based on quantification of attributes and best describe behaviors that do not have clear boundaries and are distributed continuously (APA, 1994).

Advantages of Dimensional Methods of Classification

Dimensional methods of classification appear advantageous to categorical methods for a variety of reasons including their ability to account for many of the shortcomings of categorical methods of classification. First, dimensional methods more adequately portray the agreement among many research findings that supports the notion that symptomatology for children and adolescents is dimensionally distributed. Research suggests that children who qualify for diagnoses are quantitatively different (Sroufe, 1997) and that these quantitative differences are of greater import than qualitative differences for classification purposes (Deater Deckard, Reiss, Hetherington, & Plomin, 1997). Furthermore, it has been argued that knowing the exact nature of a disorder may be less important than assessing for the severity of dysfunction (Clark, Watson, & Reynolds, 1995). Dimensional classification models are in accordance with research regarding quantitative differences and take severity into account by calculating the individual's deviance from the norm.

Second, the use of dimensional classification methods prevents many of the problems with comorbidity and atypical, mixed, and not otherwise specified categories (Westen, Heim,

Morrison, Patterson, & Campbell, 2002). Dimensional methods report clinical symptom presentations that might be subthreshold, comorbid, or atypical in a categorical system of classification, thus communicating a wider range of information.

Third, dimensional systems increase the reliability and validity of diagnosis (APA, 1994). Evidence suggests that there are not true, or clinically meaningful, qualitative points where individuals should be categorically separated, or "diagnosed" (Sroufe, 1997; Widiger, 1992), supporting the need for dimensional methods. When quantitative symptoms are artificially converted to a dichotomous, categorical scale then reliable and valid information is often lost (Widiger, 1992). Therefore, reliability and validity are increased by using a set of scores examined through factor analysis and other statistical approaches (Arend, et al., 1996), and by not arbitrarily forming dichotomous variables from continuous variables (Westen, Heim, Morrison, Patterson, & Campbell, 2002).

Disadvantages of Dimensional Methods of Classification

Limitations of dimensional models of classification are also apparent. These limitations include descriptors that are less concise and familiar to researchers and clinicians, thus limiting the ease of communication afforded by categorical systems. However, the description offered by psychiatric categorical systems might be misleading because they will not always recognize the complexity that exists within individuals (Widiger, 1992). Another limitation of dimensional methods is that agreement has not been reached as to the optimal dimensions that could be used for classification purposes (APA, 1994). Furthermore, dimensional methods that require inferential statistics and computational methods might prove cumbersome and more difficult to understand than a categorical name. To date, dimensional methods have been rejected as an

alternative to categorical methods due to issues such as clinical utility and lack of consensus (Clark, Watson, & Reynolds, 1995).

There continues to be an inadequate number of studies that directly examine the relationship between categorical and dimensional classification systems (Arend et al., 1996). It has been suggested that categorical methods might be more useful for some syndromes, while dimensional methods might better explain others (Meehl, 1995). A study by Arend, et al., (1996) compared categorical and dimensional approaches to classification in preschool children and failed to provide sufficient evidence to suggest one approach over the other. As there are significant advantages and disadvantages of both categorical and dimensional approaches to classification, and superiority among the systems has not yet been unequivocally established, it has been recommended that the systems be used in combination to learn the strengths and weaknesses of each system (Mattison & Spitznagel, 1999; Widiger, 1992). However, certain issues such as comorbidity continue to produce complicated results when the two systems are used together (Mattison, 1998), and neither classification method may adequately deal with the issue of comorbidity (Nathan & Langenbucher, 1999).

Person-oriented Methods of Classification

A blending of categorical and dimensional classifications might appear to be ideal. The advantages of both methods could be accounted for to lead to a more accurate method of classification. As Clark et al., (1997) suggest, “It is widely believed that categorical and dimensional models are inherently incompatible, and that one must choose between them. In actuality, however, it is more accurate to describe these models as existing in a hierarchical relation to one another, with dimensions being the blocks from which categories may be built”

(Nathan & Langenbucher, 1999). Person-oriented, or multivariate, classification methods blend the aforementioned classification systems by producing a categorical classification through the use of dimensional scales. The resulting categorical classification uses many dimensional symptom measures and simultaneously accounts for behaviors along these dimensions while also accounting for severity of behaviors. The interaction among those variables is also accounted for to create a more meaningful classification system. Therefore, person oriented approaches are seen as "complementary not competing" with variable oriented research (Magnusson & Bergman, 1990).

Person-oriented methods of classification differ from categorical and dimensional methods primarily in that they focus on the multiple characteristics of the individual, as opposed to variables. Variable oriented approaches do not account for the significance of the variables to the individual, while person-oriented approaches consider the individual as a whole and not just as variables (Bergman, 2000; Wangby, Bergman, & Magnusson, 1999; Bergman & Magnusson, 1997). Individuals, as opposed to variables, are grouped into categories based on the similarities in their profile of available data (Magnusson & Cairns, 1996). Person-oriented methods capture quantitative differences in symptomology through dimensional scales with the goal of creating a profile of traits that underlie the disorder. These profiles can then be used as a categorical classification tool.

Advantages of Person-oriented Methods of Classification

Current psychiatric classification systems do not adequately consider individual development, whereas person-oriented systems focus on individuals (Sroufe & Rutter, 1984; Bergman & Magnusson, 1997). This focus on the individual fits well within theoretical models emphasizing holistic, dynamic, biopsychosocial, and biologically based systems of development.

A common assumption of holistic, dynamic theoretical models is that individuals function as integrated organisms and are continuously interacting with their environment (Magnusson & Cairns, 1996). In a multivariate, or person-oriented model, all behaviors are assumed to interact with each other to generate the pattern of behavior that is observed, which is a basic premise of the dynamic systems point of view. Person-oriented research is also consistent with the biopsychosocial view of development, emphasizing the interactional and synergistic nature of systems on development (Waddington, 1971). Additionally, using multiple dimensions to classify behavior is in agreement with Gottlieb's biological-based theory that an individual's biological makeup and behavioral systems affect behavior (Gottlieb, 1991). This approach simultaneously accounts for behavior along several dimensions so that the interactions between the multiple variables and their interactions within their contexts of development can be accounted for (Kamphaus, DiStefano, & Lease, 2003).

Theoretically, person-oriented methods of classification are superior to categorical and dimensional methods, which fail to account for the interactional and additive nature among variables. Furthermore, multivariate methods have the ability to include information from a wide variety of sources. Parents, teachers, observations, and self-report measures can all contribute to a more accurate classification system. Children that might be healthy or below diagnostic thresholds can also be included in these classification systems, which allow for the use of large, representative samples to more adequately study the full range of child behavior (Kamphaus, Huberty, DiStefano, & Petoskey, 1997). Currently, person-oriented approaches appear to be closer than variable-oriented approaches to a realistic view of development (Bergman & Magnusson, 1997) and allow for a more comprehensive understanding of the complexity and range of child behaviors (Meehl, 1995; Speece & Cooper, 1991).

Person-oriented methods of classification also account for, and provide greater sensitivity to, symptom severity and comorbidity to determine a suitable classification decision (LaCombe, et al., 1991; Mash & Dozois, 1996). Initial research indicates that a multivariate approach to classification is superior to the DSM, a psychiatric classification method, with regard to dealing with the issue of comorbidity. van Lier, Verhulst, van der Ende, and Crijnen (2003) used a parent rating scale, the Child Behavior Checklist (CBCL), to determine whether patterns of disruptive disorders can be explained by a DSM diagnosis. Latent class analysis, a person-oriented method, was used to identify classes of children differing in patterns of disruptive behavior. Results indicated that no classes were found in which children only had symptoms of a DSM diagnosis. The researchers concluded that person-centered approaches, such as latent class analysis, should be employed rather than classification based on pre-determined cut scores (van Lier, Verhulst, van der Ende, & Crijnen, 2003). A person-oriented approach to examining correlates of early conduct problems was again found to be more valuable than variable oriented analysis in a study conducted by Greenberg, Speltz, DeKlyen, and Jones (2001).

Statistical Methods for Person-Oriented Classification

The ability of person-oriented methods to deal with complex interactions and comorbidities and the focus on the individual has lead to an increased interest in the statistical methods that can classify individuals (Bergman & Magnusson, 1997). These statistical methods are consistent with theoretical approaches by seeking to capture the whole profile of variables that reflect the individual (Bergman, 2000). Cluster analytic methods were used in the 1960's and 1970's in an attempt to create new classification systems but these methods were largely abandoned for this purpose due to statistical and practical issues (Blashfield, 1998). However, multivariate statistical techniques, such as cluster analysis (CA) and latent class analysis (LCA),

have improved and are more widely used and understood. The construction of homogeneous groups, or clusters, of individuals is accomplished through cluster and latent class analysis (Bergman & Magnusson, 1997). The specific method chosen should depend on the specific case (Bergman, 2000).

Cluster analysis is a classification procedure that is used to group latent groups of people together from an underlying data set (Anderberg, 1973; Aldenderfer & Blashfield, 1984; Blashfield & Aldenderfer, 1988; Hartigan, 1975; Milligan & Cooper, 1987). The goal is to divide a heterogeneous sample of individuals into subgroups that are homogenous (Speece, 1995). Individuals are assigned to a cluster with which they are most similar to a "typical" member of the cluster (Kamphaus, 2004). Specifically, centroid information and cluster characteristics are examined for each cluster and then compared to the individual case. Through cluster analysis a set of descriptions, or typology, can be created by identifying typical patterns and then individuals can be classified according to this typology (Wangby, Bergman, & Magnusson, 1999; Bergman 2000).

Latent class analysis is another classification procedure similar to cluster analysis in that they both seek to classify individuals into groups, or clusters, where individuals in a cluster are similar to each other and dissimilar to individuals in other clusters (Vermunt & Magidson, 2002). The primary goal of LCA is to explain the relationships among variables using the smallest number of classes of individuals with similar patterns of behavior (van Lier, Verhulst, van der Ende, & Crijnen, 2003). A primary difference between CA and LCA is that LCA identifies cases using a model-based method, wherein an underlying statistical model is used to identify similar classes of people (Muthen & Muthen, 2000). LCA also uses an iterative estimation

function to assign individuals to classes and uses statistical indices to determine the optimal number of classes (Vermunt & Magidson, 2002).

Preliminary Support for Person-Oriented Profile Types

The stability and predictive validity of clusters, or classes of individuals, has been studied. Mattison and Spitznagel (1999) studied the long-term stability of profile types as determined through the use of the Child Behavior Checklist (CBCL), a parent rating scale. Profile types were created through cluster analysis in an attempt to represent the complete clinical presentation of the children. Children were originally classified into a profile type, or cluster, and were then re-clustered 4.8 years later. Results indicated that the stability for profile types was good and similar to past results using CBCL and DSM diagnosis. By determining the individual's profile types, prediction of the child's diagnostic course could be made (Mattison & Spitznagel, 1999).

Flanagan, Bierman, and Kam (2003) found that cluster membership is predictive of later outcomes for first grade children. They found that strong evidence of sensitivity (proportion of children correctly classified as at risk) and specificity (proportion of children correctly classified as not at risk) resulted from using a person-oriented approach to forming profiles. Toshiaki, Awaji, Nakazato, and Sumita (1995) found cluster membership to be predictive of outcomes in adults. While some studies suggest that multivariate approaches to classification allow for greater predictive validity (Fergusson & Horwood, 1995), others have shown prediction to be equally accurate using both cluster and variable approaches (Haapasalo, Tremblay, Boulerice, & Vitaro, 2000).

While evidence exists that many latent traits are invariant in structure and quantity across cultures (Crijnen, Achenbach, & Verhulst, 1999), person-oriented methods of classification are

not yet viable alternatives to traditional diagnostic categories because there is not yet a substantial accumulation of evidence suggesting that cluster types can be replicated across samples and instruments (Lessing, Williams, & Gil, 1982). A classification system utilizing teacher ratings for child behavior in schools is gaining wider acceptance in that clusters solutions can be replicated across samples. In a series of studies by Kamphaus and colleagues a seven-cluster solution was substantially replicated across: samples in the U.S. population (Kamphaus, et al., 1997), a U.S. urban sample (DiStefano, et al., 2003), a U.S. rural sample (DiStefano, et al., 2003), and a sample in Medellin, Colombia (Kamphaus & DiStefano, 2001).

Evidence of instrument independent replication is more scarce, but holds promise and suggests that some clusters of behavior, or profile types, are partially instrument independent (DiStefano, Kamphaus, Horne, & Winsor, 2003; Kamphaus, DiStefano, & Lease, 2003; Kamphaus, Petoskey, Cody, Rowe, Huberty, & Reynolds, 1999; Huberty, DiStefano, & Kamphaus, 1997; Kamphaus, Huberty, DiStefano, & Petosky, 1997). Studies by Caspi and Silva (1995), Flanagan et al. (2003), Curry and Thompson (1985), and Lessing, Williams, and Gil (1982) produced comparable clusters or classes of children with independent instruments, which also appear to overlap with the seven cluster solution found by Kamphaus, et al. (1997). This seven-cluster solution has been proposed to be adequate for classifying the behavioral adjustment of children in elementary school (Kamphaus, DiStefano, & Lease, 2003).

Disadvantages of Person-Oriented Methods of Classification

While the advantages of person-oriented methods of classification appear to be promising, distinct disadvantages of this method remain. It has been suggested that the real world applicability of clusters is limited because it involves a complex process to assign individuals to cluster membership. Additionally, classification systems derived from cluster

analysis have not yet provided a substantial amount of information about their clinical and predictive value (Speece, 1995; Mattison & Spitznagel, 1999). The utility of clusters to inform clinicians about the future behavior of individuals is unknown (Blanchard, Morgenstern, Morgan, Labouvie, & Bux, 2003), suggesting the need for further studies on the predictive validity of clusters of individuals. Lessing, Williams, and Gil (1982) also suggested that cluster classification systems are just as vulnerable to reliability and validity problems as systems of psychiatric diagnosis. To summarize, person-oriented classification systems still lack the research base and understanding necessary to transform or replace current diagnostic systems.

Conclusions

The shortcomings of current classification systems are well documented in the research literature (Blashfield, 1998; Houts, 2002; Lessing, 1982; Richters, 1997; Scotti & Morris, 2000) and dissatisfaction with these available clinical taxonomies remains (Malik & Beutler, 2002; Houts, 2002; Joiner & Schmidt, 2002). However, despite these shortcomings, clinicians and researchers continue to classify and diagnose individuals for a variety of purposes, such as improved communication among professionals and ease of clinical description (Blashfield, 1998). Classification will continue and, therefore, it is imperative that classification systems advance along with empirical knowledge.

The most widely used method for classification, the DSM, involves categorical methods to classify behavior while research suggests that behavior is distributed along a continuum, or dimensionally (Deater-Deckard, et al., 1997; Fergusson & Horwood, 1995). These psychiatric methods have constrained research and scientific advancement (Sroufe, 1997) and it has been recommended that researchers use more quantitative, dimensional methods (Widiger, 1992).

Dimensional methods improve on categorical methods but still make classification decisions based on the presence or absence of variables, without accounting for the multiple characteristics of the individual.

Person-oriented, or multivariate, methods appear to be gaining support for classification purposes due to: consistency with current theoretical models of psychological systems development (Gottlieb, 2000; Waddington, 1971), the ability to more closely mirror empirical knowledge about symptomatology (van Lier, et al, 2003), advancements in test construction and validation (Kamphaus & Frick, 2002), the availability of appropriate statistical techniques (Bergman & Magnusson, 1997), and the potential ease of use due to the resulting categorical classification system (Clark, et al., 1997).

Future Research Needs

Through a critique of the current classification methods, it is apparent that there is not yet a perfect system for classification. Both advantages and disadvantages of psychiatric, dimensional, and person-oriented methods of classification are evident. The parsimony and ease of communication that a categorical method of classification provides is unquestionable. The unanswered question, however, is how to best form categories for classification. Should categories be formed by examining symptoms as if they form discrete categories (psychiatric), by making use of dimensional scales (dimensional), or by utilizing multiple dimensional scales to form categories (person-oriented)? Research suggests that certain methods might be superior for classifying certain types of behavior while disadvantageous for classifying other behaviors (Meehl, 1995). For example, the use of dimensional or person-oriented methods appears to be promising for symptoms that are quantitatively distributed, while the use of psychiatric methods could be more applicable to symptoms that are qualitatively different. In the past, attempts have

been made to develop a classification method useful for all psychopathology, against empirical knowledge suggesting the inadequacies of this singular approach. To date, research has not been undertaken with the idea of using separate classification methods to form categories for diverse symptomology and circumstances. Future research programs must involve determining the optimal classification methods for specific circumstances.

With attention to the situations or conditions that could be advantageous to each method, the relative superiority of classification systems should be established through explicit comparisons (Achenbach, 1990). Research is needed to systematically compare methods of classification to discern which methods fit best with empirically supported knowledge of behavior, as well as which methods demonstrate adequate predictive validity, utility, and replicability (Blanchard, et al., 2003; Jablensky, 1999; Fergusson & Horwood, 1995; Mattison & Spitznagel, 1999; Lessing, et al., 1982). While van Lier, et al. (2003), examined whether patterns of behavior fit with the conceptualization of psychiatric disorders, a direct comparison between person-oriented and psychiatric methods of classification was not made. Specifically, psychiatric diagnoses were not compared to latent classes. In fact, few studies have directly examined the relationship between categorical and dimensional approaches to classification (Arend, Lavigne, Rosenbaum, Binns, & Christoffel, 1996). Final conclusions about the superiority of various methods of classification for specific circumstances await additional empirical research involving direct comparisons (Nathan & Langenbucher, 1999).

Taxometric methods, commonly used by adult psychopathologists, are additional classification methods that should be considered for use in classifying the behaviors of childhood. These methods are concerned with identifying discrete behavior syndromes that would allow for a non-arbitrary distinction between individuals that do and do not have a

disorder. Coherent cut kinetics (CCKs) algorithms, such as MAXSLOPE, MAXCOV, and MAMBAC procedures attempt to identify latent taxa that are truly discrete, a limitation of other person-oriented classification methods. These approaches have the potential to identify children who are at risk of developing psychopathology, identify discrete subtypes of disorders, and locate crucial periods in the development of psychopathology (Beauchaine, 2003), critical tasks for developmental psychologists concerned with diagnosis and classification. Prospective, theoretically designed research studies with large sample sizes, valid indicators from multiple levels of analysis, and precise measurement instruments could provide useful information for classifying childhood behaviors (Beauchaine, 2003).

Finally, classification systems that better account for etiology are needed. Evidence suggests that genetic factors make substantial contributions to a variety of mental disorders and etiological research could potentially provide the most convincing evidence for the validity of classification systems (Kendall, 2002). Research into the etiological basis of disorders should be conducted, and classification methods that can account for etiology should be utilized. Future research should attempt to establish a classification model that will be superior to current taxonomies, with respect to etiology. However, until studies are undertaken to explicitly compare these classification models, to reliably demonstrate superiority between the models, and to demonstrate evidence of utility and validity, less than optimal systems of classification will continue to be used to the detriment of this field.

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CHAPTER 2

A COMPARISON OF CLASSIFICATION METHODS FOR USE IN PREDICTING SCHOOL-BASED OUTCOMES

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ABSTRACT

There is growing evidence that current classification methods are not consistent with current empirical knowledge of childhood psychopathology and the optimal way to classify school age children is still unproven. To date, few systematic comparisons of alternative classification methods have been conducted. A direct comparison of methods is needed and relative superiority for predicting later outcomes should be established. Purpose: The purpose of the current study was twofold: 1) to classify children into categories according to psychiatric, dimensional, and person-oriented methods and 2) to determine the comparative advantages of classification methods for predicting school-based outcomes. Method: The sample consisted of 558 children participating in the Project ACT Early study during the 1999-2000 academic years (grades 1-5). Children's behavior problems and adaptive competencies were assessed with the Behavior Assessment System for Children – Teacher Rating Scale and results were used to form three classification systems. Each child was concurrently placed into these three separate classification systems: a psychiatric, dimensional, and person-oriented system. Educational outcome variables were collected seven and nineteen months later and the predictive validity of the three classification systems was compared using regression techniques. Results: The value of the psychiatric, dimensional, and person-oriented methods for predicting educational outcomes was modest. All three classification approaches yielded results suggesting that they were best able to predict later grade point averages. Results indicate the relative superiority of person-oriented and dimensional methods of classification over the frequently used psychiatric methods; however these methods should be further investigated.

INDEX WORDS: Classification, Person-oriented, Dimensional

INTRODUCTION

The fields of psychiatry and psychology have been grappling with the issue of classification for decades. Practitioners, researchers, and educators agree about the importance of classification for a variety of reasons including enhanced communication among professionals, ease of description, and the ability to differentiate individuals (Scotti & Morris, 2000; Blashfield, 1998; Cantwell, 1996). However, consensus on the optimal way to classify individuals has not yet been achieved. The necessity for consensus and, more importantly, an accurate classification system is imperative for scientific progress and the effective treatment of individuals.

The need for precise classification is especially important for work with school age children. Many children do not receive the mental health services that they need, in part due to the inadequate methods of classification currently in use. Children are often classified into groups that receive services only after they exhibit significant impairment. This "wait-to-fail" treatment approach could result from current classification systems that fail to identify subsyndromal psychopathology (Cantwell, 1996) or current risk status. Classification systems that more accurately identify children for services are thus needed as these systems could effectively aid daily decisions regarding prevention, early intervention, and treatment for children.

Accurate classification is particularly critical considering the fact that the developmental courses or pathways of school-age children are likely to be influenced by subsequent outcomes (Sroufe, 1997). Insight into children's adjustment and risk status (Kagan, 1997), tracking developmental pathways (Richters, 1997), differentiating individuals by etiology (Cantwell,

1996), and predicting effective treatment approaches (Scotti & Morris, 2000) are among the most salient reasons that accurate classification in school-age children is key.

The debate surrounding accurate classification methods and the dissatisfaction with current systems of classification is increasing. There is growing consensus that current diagnostic systems have lagged behind the increase in knowledge about psychopathology and classification (Beutler & Malik, 2002; Houts, 2002; Helzer & Hudziak, 2002; Jablensky, 1999). Currently most researchers rely upon psychiatric, categorical approaches such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) for the purpose of classification (American Psychiatric Association, 1994). This approach uses variables to form "all-or-nothing" categories based on the assumption that disorders form discrete categories (Millon, 1991).

Similarly, school age children have primarily been classified and diagnosed through psychiatric, or categorical, methods. Specifically, students have generally been placed into discrete, all or nothing categories specified by the DSM (DSM-IV; American Psychiatric Association) or the Individuals with Disabilities Education Act (IDEA). There are several limitations to these methods of classification. One major limitation of a psychiatric categorical approach, similar to the medical model, is that only qualitative differences are noted. However, throughout the scientific literature evidence exists suggesting that symptoms of hyperactivity/impulsivity, inattention, conduct problems, depression, and anxiety occur along a continuum, or show evidence of quantitative differences (Deater-Deckard, Reiss, Hetherington, & Plomin, 1997; Fergusson & Horwood, 1995; Hudziak, Heath, Madden, Reich, Bucholz, Slutske, Bierut, et al., 1998; Hudziak, Wadsworth, Heath, & Achenbach, 1999; Neuman, Todd, Heath, Reich, Hudziak, Bucholz, Madden, Begleiter, Porjesz, Kupermana, Hesselbrock, & Reich, 1999; Scahill, Schwab-Stone, Merikangas, Leckman, Zhang, & Kasl, 1999; Nease, Volk,

& Cass, 1999). Other limitations of psychiatric classification methods include the failure to account for comorbidity (van Lier, Verhulst, van der Ende, & Crijnen, 2003) and normally or marginally functional behavioral systems (Jensen, et al., 1996), and the reliance on clinical judgment (Jablensky, 1999).

Failure to account for subsyndromal psychopathology (Cantwell, 1996) has also been identified as a limitation of psychiatric methods. A study by Scahill, et al. (1999) found that children beneath the diagnostic threshold for ADHD still possessed evidence of functional impairment in school, which was nearly identical to the impairment experienced by children above the diagnostic threshold. This study suggests that under a purely categorical model, such as the DSM-IV or IDEA, students that experience functional impairment might not be classified, and thus fail to receive services. Under current classification systems, children are only classified once they have exhibited a critical level of psychopathology and schools only provide services for these children experiencing the most severe difficulties. Individuals with a more moderate, although perhaps substantial, risk are not included for classification and therefore do not receive services. Furthermore, there is no classification or differentiation among individuals with lower levels of risk status, yielding no useful information for planning prevention or early intervention services.

With such limitations of psychiatric methods known, dimensional and person-oriented methods have been proposed as alternative approaches to classification. Dimensional approaches to classification assume that behavior does not occur dichotomously, but rather along a continuum. Descriptive variables are collected and combined with other correlated variables to form a dimension, which summarizes information about the descriptive variables into an abstract, higher-order variable (Blashfield, 1998). Dimensional methods of classification show

improvement over psychiatric methods in that they account for quantitative differences in symptomatology. Namely, this method includes a wider variety of information and has the ability to identify and classify all children, not just the ones with the most severe psychopathology. However, dimensional methods still focus on variables of interest and produce a system that is arguably less parsimonious than a categorical system of classification (Helzer & Hudziak, 2000).

Person-oriented, or multivariate, methods of classification attempt to blend categorical and dimensional methods by producing a categorical classification system through the use of dimensional scales. The resulting typology is a different type of categorical classification system that encompasses a full range of dimensionally scaled variables. Additionally, person-oriented approaches have been proposed due to their strength in emphasizing the individual as a whole, not just a linear combination of variables (Bergman & Magnusson, 1997). This person-oriented approach to a typology of behavior is conducive to a fuller understanding of the complexity and range of child behaviors (Meehl, 1995; Speece & Cooper, 1991) and provides consistency with psychological theoretical models of psychological systems development (Gottlieb, 2000; Waddington, 1971). Multivariate behavior typologies, derived through cluster analytic techniques, are also gaining wider acceptance as a model of classification due to the evidence supporting the relative superiority of multivariate methods in explaining the complex interactions, correlates, and comorbidities in children (van Lier, Verhulst, van der Ende, & Crijnen, 2003; Greenberg, Speltz, DeKlyen, & Jones, 2001).

Multivariate techniques, such as cluster analysis (CA) and latent class analysis (LCA), are used to construct homogeneous groups of individuals from an underlying data set (Anderberg, 1973; Aldenderfer & Blasfield, 1984; Blashfield & Aldenderfer, 1988; Hartigan,

1975; Milligan & Cooper, 1987). In effect, these person-oriented methods produce a classification system, or a set of clusters, which is categorical yet produced through the use of multiple dimensional scales. Preliminary research evidence suggests that behavior typologies created through these multivariate techniques show evidence of: external replication (DiStefano, Kamphaus, Horne, & Winsor, 2003), stability (Mattison & Spitznagel, 1999), replication across samples and instruments (Kamphaus, et al., 1997; DiStefano, et al., 2003, Kamphaus & DiStefano, 2001), and predictive validity (Flanagan, Bierman, & Kam, 2003; Toshiaki, Aawaji, Nakazato, & Sumita, 1995; Fergusson & Horwood, 1995).

Teacher-, parent-, and self-report rating scales have become the standard for creating these homogeneous groups, or clusters, of behavioral adjustment (Hart & Lahey, 1999) and appear to be useful for classification due to their considerable validity evidence. Evidence consistently suggests that rating scales produce evidence of predictive validity (Flanagan, Bierman, & Kam, 2003; Haapasalo, Tremblay, Boulerice, & Vitaro, 2000; Verhulst, Koot, & van der Ende, 1994; Aronen, et al., 1999) and concurrent validity (Morgan & Cauce, 1999). Teacher rating scales, in particular, have been found to be more reliable than parent rating scales (Reynolds & Kamphaus, 1992) and to be either equivalent, or superior, to the latter for predicting later psychopathology (Flanagan, et al, 2003; Verhulst, et al., 1994). Furthermore, Johnston and Murray (2003) suggest that combining information from multiple raters might not improve the accuracy of diagnosis (Johnston & Murray, 2003). Additionally, teacher ratings have shown to be particularly useful for identifying children at the extremes of symptom distributions (Hart & Lahey, 1999). These findings support the view that teacher ratings of child behavior might be useful as a sole diagnostic tool in creating a meaningful behavioral typology.

However, before behavioral typologies are proposed as an alternative classification method a direct comparison of methods needs to be made. Few such systematic comparisons of alternative classification methods have been conducted (Jensen, Watanabe, Richters, Roper, Hibbs, Salzberg, and Liu, 1996; Arend, Lavigne, Rosenbaum, Binns, & Christoffel, 1996; Fergusson & Horwood, 1995). Fergusson and Horwood (1995) examined the relationship between categorical methods, dimensional methods, and a series of outcome measures and found dimensional methods to result in stronger predictions of outcomes. However, findings by Jensen et al. (1996) suggest that psychiatric and dimensional approaches to classification might produce similar results when similar methods are used, even though highly specific psychiatric categories show fewer relationships with external validators. Furthermore, Mattison and Spitznagel (1998) found prior studies comparing DSM categories to Child Behavior Checklist dimensional scales that suggest that neither system is superior when compared to external validators.

Furthermore, while clusters, derived from such diagnostic tools as teacher rating scales, are considered more effective than psychiatric and dimensional classification in understanding the complexity of individual behaviors, it is not known whether they demonstrate an increased ability to predict future outcomes. The ability of a classification system to predict future outcomes should guide thinking about its utility (Bergman & Magnusson, 1997). Before cluster-analytically derived typologies can be introduced as alternatives to psychiatric or dimensional classification methods, research must demonstrate their ability to predict and generalize based on the attributes of the individual (Lessing, 1982). For example, it is unknown if the additional dimensional scales used to create a person-oriented classification system are more predictive than the single dimensional scale used in a dimensional system.

Initial research by Flanagan, Bierman, and Kam (2003) found cluster membership to be predictive of later outcomes for first grade children, and Toshiaki, Awaji, Nakazato, and Sumita (1995) found cluster membership to be predictive of outcomes in adults. Additionally, Fergusson and Horwood (1995) found dimensionally scored measures to show better evidence of predictive validity than categorical methods. A study by Greenberg, Speltz, DeKlyen, and Jones (2001) found person-oriented methods to be superior to individual variable approaches in significantly predicting risk factors of conduct problems. However, Haapasalo, Tremblay, Boulerice, and Vitaro (2000) found prediction of problem behavior in kindergartners to be equally accurate using either cluster or variable approaches. Blanchard, Morgenstern, Morgan, Labouvie, and Bux (2003), in a study designed to examine the predictive validity of subtypes and a continuous measure, concluded that the utility of clusters to inform clinicians about the future behavior of individuals is unknown. These discrepant findings suggest that additional research should be conducted on the predictive validity of classification methods.

The optimal way to classify school age children is still unproven. A direct comparison of methods is needed and relative superiority for predicting later outcomes should be established. The current study sought to classify children according to three commonly used classification methods: psychiatric, dimensional, and person-oriented methods. Then, these classification methods were directly compared by determining their individual ability to accurately predict educational outcomes. The utility of a classification system should be based, in part, on its ability to predict both concurrent and longitudinal outcomes. In sum, the purpose of the current study was twofold: to classify children into categories according to psychiatric, dimensional, and person-oriented methods and to determine the comparative advantages of classification methods for predicting school-based outcomes.

METHOD

Subjects

Data for this study were collected as part of Project ACT Early, funded by Field-Initiated Studies grants (R306F60158, R305T990330) from the Institute for At-Risk Children of the Office of Educational Research and Improvement, United States Department of Education. (Grant principal investigators: Jean A. Baker, Randy W. Kamphaus, and Arthur M. Horne). Project ACT Early was a research grant designed to study the ecological context of risk in elementary schools and was aimed at teacher professional development designed to improve classroom management. The sample consisted of 558 children participating in the Project ACT Early study during the 1999-2000 academic years (grades 1-5).

The sample (N=558) is approximately one half female (N= 298; 53.4%). Approximately 52 percent of the children were African American (N=295), 30 percent Caucasian (N=169), 7 percent Hispanic (N=38), 2 percent Asian American (N=10), and 2 percent multiracial (N=13).

A sub-sample of the 558 children (N=334) who participated in Project ACT Early for two consecutive years was formed in order to assess the ability to predict longitudinal outcomes. The sub-sample is approximately one half female (N= 173; 51.8%). Approximately 54 percent of the children are African American (N=180), 32 percent Caucasian (N=109), 6 percent Hispanic (N=19), 2 percent Asian American (N=8), and 2 percent multiracial (N=9).

The samples were collected from three schools in Athens-Clarke County, a public school district in northeast Georgia, which have been described as “at risk.” “At risk” status is based on several educational factors such as 58.2% of the population being eligible for free or reduced lunch and approximately 23% of Athens-Clarke County residents having not completed high school.

Instruments

Children's behavior problems and adaptive competencies were assessed with the Behavior Assessment System for Children (BASC; Reynolds & Kamphaus, 1992). The BASC consists of a series of multidimensional behavior rating scales designed for three different raters: parent, teacher, and self, and for three different age groups: preschool (ages 4-5), children (ages 6-11), and adolescents (ages 12-18). The BASC-Teacher Rating Scale-Child (TRS-C), designed for students ages 6-11, was the instrument used in this study. Children in the 1st through 5th grade who were administered either the preschool or adolescent form, due to their age at the time of testing, were eliminated from this study.

The BASC-TRS-C is a 148-item, nationally standardized measure that yields ten problem behavior scales and four adaptive behavior scales (Reynolds and Kamphaus, 1992). The 10 problem behavior sub-scales assess the following externalizing, internalizing, and school related problems: Aggression, Hyperactivity, Conduct Problems, Anxiety, Depression, Somatization, Attention Problems, Learning Problems, Atypicality, and Withdrawal. Adaptability, Leadership, Social Skills, and Study Skills assess a student's adaptive skills.

The BASC manual provides reliability and validity psychometric information and descriptions of the TRS-C scales. Evidence of internal consistency (median internal consistency coefficient of .82), test-retest, and inter-rater reliability is provided. The TRS also shows high correlations with other teacher rating scales that measure similar constructs (Reynolds & Kamphaus, 1992). The 148 behavioral items are rated on a 4-point Likert scale (1=never, 2=sometimes, 3=often, 4=almost always).

Procedure

BASC-Teacher Rating Scales were collected in October of the 1999 academic school year for each participating child. Results from the BASC-TRS were used to form three classification models: a categorical classification model examining symptoms based on DSM-IV criteria (psychiatric), a dimensional system based on dimensional scales (dimensional), and a categorical system formed by examining the multiple dimensions of symptoms exhibited by individuals (person-oriented). Each child was concurrently placed into these three separate classification systems: a psychiatric, dimensional, and person-oriented system.

Approximately seven months later, in May of 2000, educational outcome variables were collected for each child. Additionally, educational outcome variables were collected again in May of 2001 (approximately 19 months later) for the sub-sample of children who participated in the study for two consecutive years. The predictive validity of the three classification systems was compared using regression techniques.

Psychiatric Classification Model

To construct a model consistent with DSM-IV criteria (American Psychiatric Association, 1994), the BASC-TRS-C was inspected for items with content similar to diagnostic criteria following the procedure of van Lier, et al., (2003). Based on this analysis, it was determined that a sufficient amount of items existed to account for symptoms of inattention, hyperactivity, impulsivity, oppositional defiance, conduct, and anxiety. However, due to sample sizes needed for regression techniques, diagnostic groups were formed only if 25 individuals from the sample met diagnostic criteria.

The following diagnostic groups were formed based on items consistent with a DSM-IV diagnosis: (1) Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type;

(ADHDI; DSM-IV 314.00) and (2) Oppositional Defiant Disorder (ODD; DSM-IV 313.81). Additionally, empirical research suggests considerable overlap, or comorbidity, between behavior disorders, specifically ADHD, CD, and ODD. Studies indicate that between 35% and 60% of clinic-referred children with ADHD will meet diagnostic criteria of ODD and 30% to 50% will meet CD criteria (Barkley, 1996). Furthermore, Hinshaw and Anderson (1996) indicate that it is impossible to claim that conduct problems are a completely separate domain than attention deficits/hyperactivity. To account for this considerable overlap, a 3rd diagnostic group was formed that consisted of children with ADHD plus another behavior disorder, specifically (3) ADHD + CD or ODD.

A 4th diagnostic group was formed to account for the comorbidity between Generalized Anxiety Disorder and Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type. This group consisted of children who met criteria for Generalized Anxiety Disorder (GAD; DSM-IV 300.02) or met criteria for both Generalized Anxiety Disorder (GAD; DSM-IV 300.02) and Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type (DSM-IV 314.00): (4) GAD and GAD + ADHD, Predominantly Inattentive Type. A 5th group, (5) Other, was also formed to capture individuals that met diagnostic criteria for a disorder with symptoms of inattention, hyperactivity, impulsivity, oppositional defiance, conduct, and anxiety but could not be analyzed separately due to small sample sizes. Specifically, this group consisted of individuals that met diagnostic criteria for either Attention-Deficit/Hyperactivity Disorder, Combined Type (ADHD; DSM-IV 314.01), Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type (DSM-IV 314.01), Conduct Disorder, Childhood or Adolescent - Onset Type (CD; DSM-IV 312.81 or 312.82), or were found to be meet criteria for more than one disorder other than the comorbid conditions previously accounted for. In

summary, five psychiatric diagnostic groups were formed: (1) ADHDI, (2) ODD, (3) ADHD + CD or ODD, (4) GAD and GAD + ADHDI, and (5) Other.

To form these diagnostic groups, items that were consistent with diagnostic criteria were dichotomized where 0 = never or sometimes, and 1= often or almost always true. Individuals who scored above the diagnostic threshold for one disorder, determined by receiving ratings of often or almost always true on a sufficient number of items consistent with a particular diagnosis, were placed in that particular diagnostic category. If individuals rating scale items produced profiles consistent with one of the five diagnostic groups they were placed into that diagnostic group. Individuals could only be "diagnosed" or placed into one category. For example, individuals who met criteria for ADHD + CD or ODD could not be considered for placement into the ODD diagnostic group.

Dimensional Classification Model

Scales from the BASC-Teacher Rating Scales were combined to form a dimensional classification model. The BASC-TRS yields 10 problem behavior scales: Aggression, Hyperactivity, Conduct Problems, Anxiety, Depression, Somatization, Attention Problems, Learning Problems, Atypicality, and Withdrawal. Two overarching clinical composite dimensions are formed using these scales: Externalizing and Internalizing Problems, which are supported by factorial validity evidence. The Externalizing Problems dimension consists of disruptive behavior symptoms and is formed by combining the Hyperactivity, Aggression, and Conduct Problems scales. The Internalizing Problems dimension consists of the Anxiety, Depression, and Somatization scales (Reynolds and Kamphaus, 1992). Individuals were assigned T scores on both the Externalizing and Internalizing dimensions. These dimensional scores were used as the basis for comparison to the other two classification systems.

Person-oriented Classification Model

Teacher ratings of children, using the BASC-TRS, have been utilized in multivariate, or person-oriented, methods to develop a classification system for child behavior in school. Kamphaus, et al., (1997) used a two-step cluster analytic technique involving a Ward hierarchical analysis followed by an iterative cluster partitioning via a K-means analysis. A seven-cluster solution was proposed to classify the behavioral adjustment of children in elementary school. The proposed clusters that were found to be adequate for classification were (1) Well Adapted, (2) Average, (3) Disruptive Behavior Problems, (4) Academic Problems, (5) Physical Complaints/Worry, (6) General Problems-Severe, and (7) Mildly Disruptive. This seven-cluster solution was substantially replicated across: samples in the U.S. population (Kamphaus et al., 1997), a U.S. urban sample (DiStefano, et al., 2003), a U.S. rural sample (DiStefano, et al., 2003), and a sample in Medellin, Colombia (Kamphaus & DiStefano, 2001. Furthermore, results of a study by DiStefano, Kamphaus, Horne, and Winsor (2003) indicated that this seven-cluster solution can be replicated through independent cluster analysis, cross classification among grouping procedures, and through relationships between disciplinary actions and cluster memberships.

For the current study children were assigned to one of these seven previously constructed behavioral clusters based on their teacher's ratings. A normal–based, linear classification rule built on the aforementioned cluster solution permitted classification for the current, unclassified sample. Predictive discriminant analyses were used where the linear classification function predicts membership by assigning each individual to the cluster that it most closely resembles (Huberty, 1994; Huberty, DiStefano, & Kamphaus, 1997). Data were transformed based on a weighted cluster solution derived from the original clustering analyses. Linear composites of the

14 TRS-C sub-scales were formed in which constant weights, or linear classification functions (LFC's), were applied to the sub-scale T-scores of each individual. Results yielded a profile of seven LFC scores for each individual who was assigned to the cluster that they were most closely associated with (DiStefano, Kamphaus, Horne, & Winsor, 2003). Therefore, individuals in the current sample were placed into one of the seven previously validated clusters or groups.

Comparison of Classification Models

Once individuals were classified according to psychiatric, dimensional, and person-oriented methods the relationship between the classification models and the ability to predict educational outcome variables was assessed. A cross-sectional sample (outcomes collected in the same academic year) and a longitudinal sample (outcomes collected one academic year later) were used to assess the predictive validity of each method. The following educational outcomes were collected for each child in the cross-sectional sample (N=558): (1) Grade Point Average (GPA), (2) Iowa Test of Basic Skills Reading Composite (ITBS Reading; standardized achievement test), (3) Iowa Test of Basic Skills Mathematics Composite (ITBS Math; standardized achievement test), (4) Number of days absent, (5) Number of days tardy, (6) Number of visits to the Opportunity Room (OR, indicative of a discipline problem), and (7) Number of Suspensions. These educational outcomes were collected through examination of school records in May of 2000.

The following educational outcomes were collected for the longitudinal sample (N=334): (1) Grade Point Average (GPA), (2) Number of days absent, (3) Number of days tardy, and (4) Number of Suspensions. These educational outcomes were collected through examination of school records in May of 2001.

The predictive validity of the classification systems was examined through regression analyses. SPSS 13.0 was used to analyze the data using multiple regression techniques. Separate regression analyses were computed for each outcome variable. Through regression, unstandardized predicted values of each outcome variable using each classification method were obtained and used for comparison. Bivariate correlations were computed for each outcome, correlating the outcome with the unstandardized predicted values obtained using each classification method. Cases were excluded listwise. Then, T tests were used to compare the differential predictive validity of the three classification systems to determine if the differences were statistically significant.

For example, three predicted values were obtained for the outcome variable of GPA: a value predicting GPA using the psychiatric method, a value predicting GPA using the dimensional method, and a value predicting GPA using the person-oriented method. Then, bivariate correlations were computed to compare these predicted values and GPA. Cases that did not have data available for both methods were excluded. Then a T test was used to compare the differential predictive validity of these three systems. Specifically, the correlations of classification systems with outcomes were compared with each method (Glass & Stanley, 1970).

RESULTS

Of the 558 students participating in the cross-sectional study, 166 students met diagnostic criteria and were placed into one of the following psychiatric groups: (1) ADHDI, N=30 students (2) ODD, N=32; (3) ADHD + CD or ODD, N=41; (4) GAD and GAD + ADHDI N=25; and (5) Other, N= 38. T scores on the externalizing and internalizing dimensions were calculated for all 558 students. Scores ranged from 40 to 95 and 39 to 101 respectively. Additionally, each student was placed into one of the following person-oriented clusters: (1)

Well Adapted, N= 147 (2) Average, N=87 (3) Disruptive Behavior, N=82 Problems, (4) Academic Problems, N=66, (5) Physical Complaints/Worry, N=60 (6) General Problems-Severe, N=26 and (7) Mildly Disruptive, N=90.

Of the 334 students participating in the longitudinal sample, 90 students met diagnostic criteria and were placed into one of the following psychiatric groups: (1) ADHDI, N=15 students (2) ODD, N=17; (3) ADHD + CD or ODD, N=26; (4) GAD and GAD + ADHDI N=15; and (5) Other, N= 17. T scores on the externalizing and internalizing dimensions were calculated for all 334 students. Scores ranged from 40 to 95 and 39 to 101 respectively. Additionally, each student was placed into one of the following person-oriented clusters: (1) Well Adapted, N= 108 (2) Average, N=46 (3) Disruptive Behavior, N=47 Problems, (4) Academic Problems, N=31, (5) Physical Complaints/Worry, N=31 (6) General Problems-Severe, N=20 and (7) Mildly Disruptive, N=51.

Overall strength of prediction

Multiple regression techniques were used to predict GPA, ITBS reading and math scores, and number of days absent, days tardy, opportunity room visits, and suspensions using psychiatric (DSM), dimensional (externalizing, internalizing), and person-oriented (cluster) classification methods. Table 1 lists the overall R squared values for the cross-sectional study

TABLE 1. Classification Methods Predicting Cross-sectional Educational Outcomes

	R squared values		
Outcomes	DSM	Dimensional	Cluster
GPA	.197	.200	.366
ITBS Read	.047	.082	.110
ITBS Math	.074	.086	.100
# of Days Absent	.030	.048	.060
# of Days Tardy	.006	.013	.017
# of OR visits	.320	.416	.294
# of Suspensions	.107	.138	.079

Note: GPA = Grade Point Average; ITBS Read = Iowa Test of Basic Skills Reading composite; ITBS Math = Iowa Test of Basic Skills Mathematics composite

Longitudinal data were available for 334 of the original 558 participants. Multiple regression techniques were used to predict GPA, number of days absent, number of days tardy, and number of suspensions using psychiatric, dimensional, and person-oriented classification methods. Table 2 lists the overall R squared values for the longitudinal study.

TABLE 2. Classification Methods Predicting Longitudinal Educational Outcomes

	R squared values		
Outcomes	DSM	Dimensional	Cluster
Grade Point Average	.179	.183	.307
# of Days Absent	.007	.040	.056
# of Days Tardy	.010	.005	.020
# of Suspensions	.011	.020	.006

Predicting GPA using psychiatric, dimensional, and person-oriented methods

Correlations between GPA and the unstandardized predicted values using the three classification methods were analyzed. Table 3 depicts the correlations between GPA, the predicted value of GPA using the psychiatric method (PGPAP), the predicted value of GPA

using the dimensional method (PGPAD), and the predicted value of GPA using the person-oriented, cluster method (PGPACL). In order to make inferences about the equality of the population correlation coefficient values that used the same sample, T tests were employed. Overall, results suggest that person-oriented methods predicted GPA significantly better than either dimensional or psychiatric methods, while there was no significant difference in the prediction of GPA using dimensional or psychiatric methods.

TABLE 3. Correlations between GPA and Predicted Values - Cross-sectional

	GPA	PGPAP	PGPACL	PGPAD
GPA	1			
PGPAP	.443			
PGPACL	.605	.650		
PGPAD	.447	.735	.694	

Note: GPA = Grade Point Average; PGPAP = Predicted GPA using Psychiatric method; PGPACL = Predicted GPA using Cluster, person-oriented method; PGPAD = Predicted GPA using Dimensional method

Longitudinal data were also available for GPA. Similarly, results indicated that person-oriented methods predicted GPA significantly better than either dimensional or psychiatric methods, while there was no significant difference in the prediction of GPA using dimensional or psychiatric methods. See Table 4 for correlations between GPA and the predicted values of GPA using the longitudinal sample.

TABLE 4. Correlations between GPA and Predicted Values - Longitudinal

	GPA	PGPAP	PGPACL	PGPAD
GPA	1			
PGPAP	.423			
PGPACL	.554	.519		
PGPAD	.427	.646	.689	

Note: GPA = Grade Point Average; PGPAP = Predicted GPA using Psychiatric method; PGPACL = Predicted GPA using Cluster, person-oriented method; PGPAD = Predicted GPA using Dimensional method

Predicting standardized reading achievement scores using psychiatric, dimensional, and person-oriented methods

The ability of the three classification methods to predict standardized achievement scores was analyzed. The Iowa Test of Basic Skills, Reading Composite (ITBSRead) was used as an indicator of reading achievement. Table 5 depicts the correlations between ITBSRead and the predicted value of ITBSRead using the psychiatric method (PITBSReadP), the predicted value of ITBSRead using the dimensional method (PITBSReadD), and the predicted value of ITBSRead using the person-oriented, method (PITBSReadCL). T tests were used to examine the equality of the population correlation coefficient values. Overall, results suggest that the person-oriented method and the dimensional method predicted reading scores significantly better than the psychiatric method. There were no significant differences in using the person-oriented method and the dimensional method.

TABLE 5. Correlations between ITBS Reading and Predicted Values

	ITBSRead	PITBSReadP	PITBSReadCL	PITBSReadD
ITBSRead	1			
PITBSReadP	.217			
PITBSReadCL	.332	.583		
PITBSReadD	.287	.653	.747	

Note: ITBSRead = Iowa Test of Basic Skills Reading composite; PITBSReadP = Predicted ITBSRead using Psychiatric method; PITBSReadCL = Predicted ITBSRead using Cluster, person-oriented method; PITBSReadD = Predicted ITBSRead using Dimensional method

Predicting standardized mathematics achievement scores using psychiatric, dimensional, and person-oriented methods

The Iowa Test of Basic Skill, Mathematics Composite (ITBSMath) was used as an indicator of mathematics achievement. Table 6 depicts the correlations between ITBSMath and the predicted values using the psychiatric method (PITBSMathP), the dimensional method (PITBSMathD), and the person-oriented method (PITBSMathCL). T-tests among these values did not yield any significant differences. Therefore, the superiority of any method cannot be established for use in predicting mathematics achievement scores.

TABLE 6. Correlations between ITBS Mathematics and Predicted Values

	ITBSMath	PITBSMathP	PITBSMathCL	PITBSMathD
ITBSMath	1			
PITBSMathP	.272			
PITBSMathCL	.316	.594		
PITBSMathD	.294	.596	.807	

Note: ITBSMath = Iowa Test of Basic Skills Mathematics composite; PITBSMathP = Predicted ITBSMath using Psychiatric method; PITBSMathCL = Predicted ITBSMath using Cluster, person-oriented method; PITBSMathD = Predicted ITBSMath using Dimensional method

Predicting number of days absent using psychiatric, dimensional, and person-oriented methods

The ability of these three classification methods to predict the number of days the child was absent throughout the school year was examined. Correlations between the days absent (Absent) and the predicted values of days absent using the three different classification methods were examined. Please refer to Table 7. Results from T tests examining the significant differences between these correlations indicated that the person-oriented method predicted the number of days absent significantly better than the psychiatric method. However, no significant differences were noted between the person-oriented method and the dimensional method or the dimensional method and the psychiatric method.

TABLE 7. Correlations between Days Absent (Absent) and Predicted Values - Cross-sectional

	Absent	PAbsentP	PAbsentCL	PAbsentD
Absent	1			
PAbsentP	.174			
PAbsentCL	.246	.467		
PAbsentD	.219	.429	.734	

Note: Absent = Number of school days Absent; PAbsentP = Predicted Absent using Psychiatric method; PAbsentCL = Predicted Absent using Cluster, person-oriented method; PAbsentD = Predicted Absent using Dimensional method

The number of days absent was also available as an outcome for the longitudinal sub-sample. See Table 8 for results comparing Days Absent and Predicted Values for the longitudinal sub-sample. Similarly, results from these comparisons suggest that the person-oriented method predicted the number of days absent significantly better than the psychiatric method. No significant differences were noted between the person-oriented and dimensional methods or between the dimensional and the psychiatric methods.

TABLE 8. Correlations between Days Absent (Absent) and Predicted Values - Longitudinal

	Absent	PAbsentP	PAbsentCL	PAbsentD
Absent	1			
PAbsentP	.081			
PAbsentCL	.236	.330		
PAbsentD	.199	.308	.576	

Note: Absent = Number of school days Absent; PAbsentP = Predicted Absent using Psychiatric method; PAbsentCL = Predicted Absent using Cluster, person-oriented method; PAbsentD = Predicted Absent using Dimensional method

Predicting number of days tardy using psychiatric, dimensional, and person-oriented methods

The number of days a student was absent throughout the academic school year was examined as an outcome measure for both the cross-sectional and the longitudinal sample. No significant differences were noted between the three possible methods of predicting days tardy.

Predicting the number of opportunity room visits using psychiatric, dimensional, and person-oriented methods

The number of times a student visited the opportunity room (OR) is an indicator of discipline problems, such that a visit to the OR room constitutes being removed from their regular classroom due to being disciplined. The ability of the three classification methods to predict OR visits was analyzed. Findings suggest that the dimensional classification method is superior to the psychiatric and person-oriented method for predicting the number of OR visits. No differences were noted between the person-oriented and psychiatric methods. See Table 9.

TABLE 9. Correlations between Number of Visits to Opportunity Room and Predicted Values

	#OR	P#ORP	P#ORCL	P#ORD
#OR	1			
P#ORP	.565			
P#ORCL	.542	.723		
P#ORD	.645	.812	.797	

Note: #OR = Number of visits to the Opportunity Room; P#ORP = Predicted #OR using Psychiatric method; P#ORCL = Predicted #OR using Cluster, person-oriented method; P#ORD = Predicted #OR using Dimensional method

Predicting the number of suspensions using psychiatric, dimensional, and person-oriented methods

The number of times a student was suspended throughout the academic year was another behavioral outcome collected for both the cross-sectional and longitudinal samples. Correlations between the number of suspensions (#Suspend) and the predicted values using the psychiatric (P#SuspendP), person-oriented (P#SuspendCL), and dimensional (P#SuspendD) methods were analyzed. See Table 10. T tests examining the significant differences using these methods indicated that the dimensional method of classification was superior to the person-oriented method when predicting suspensions. No significant differences were noted between either the dimensional and psychiatric method or between the person-oriented and psychiatric method.

TABLE 10. Correlations between Number of Suspensions and Predicted Values - Cross-sectional

	#Suspend	P#SuspendP	P#SuspendCL	P#SuspendD
#Suspend	1			
P#SuspendP	.327			
P#SuspendCL	.281	.628		
P#SuspendD	.371	.663	.796	

Note: #Suspend = Number of Suspensions; P#SuspendP = Predicted #Suspend using Psychiatric method; P#SuspendCL = Predicted #Suspend using Cluster, person-oriented method; P#SuspendD = Predicted #Suspend using Dimensional method

Data on the number of suspensions was also available for examination in the longitudinal sample. In order to determine the relative superiority of the three classification systems, unstandardized predicted values predicting the number of days suspended using the classification systems were correlated with the number of days suspended. Refer to Table 11. Results from T tests suggested that there were no significant differences using psychiatric, dimensional, and person-oriented methods to predict number of suspensions.

TABLE 11. Correlations between Number of Suspensions and Predicted Values - Longitudinal

	#Suspend	P#SuspendP	P#SuspendCL	P#SuspendD
#Suspend	1			
P#SuspendP	.105			
P#SuspendCL	.143	.037		
P#SuspendD	.075	.488	.236	

Note: #Suspend = Number of Suspensions; P#SuspendP = Predicted #Suspend using Psychiatric method; P#SuspendCL = Predicted #Suspend using Cluster, person-oriented method; P#SuspendD = Predicted #Suspend using Dimensional method

DISCUSSION

The aim of this paper was to compare psychiatric, dimensional, and person-oriented methods of classification for use in predicting school based outcomes. Through examination of

overall R squared values, the value of the psychiatric, dimensional, and person-oriented methods for predicting educational outcomes was modest. All three classification approaches yielded results suggesting that they were best able to predict later grade point averages (GPA) and number of visits to the opportunity room when compared with other outcome variables. However, the overall ability of these classification models for use in predicting days absent, days tardy, and reading and math achievement is questionable. The longitudinal predictions yielded similar results to the cross-sectional predictions suggesting that the classification systems were best able to predict later grade point average.

Despite somewhat unfavorable results suggesting that these classification methods were not optimal for predicting educational outcomes, differences among the classification methods did exist. When examining GPA, person-oriented methods were clearly superior to both dimensional and psychiatric methods. In schools, GPA is often a global indicator of functioning in the classroom suggesting that person-oriented methods might allow for the prediction of global functioning. Similarly, person-oriented methods were found to be superior to psychiatric methods for predicting reading achievement scores and days absent.

Dimensional methods of classification were found to be superior to psychiatric methods for predicting reading achievement scores and number of visits to the opportunity room. Dimensional methods were also found to be better able to predict number of visits to the opportunity room and number of suspensions than person-oriented methods of classification. This finding suggests that, for behavioral outcomes, knowledge about a student's externalizing and internalizing functioning might be sufficient. In other words, the additional dimensional scales used to create a person-oriented classification system were not more predictive than the two dimensional scales of used in a dimensional system.

Psychiatric classification methods were not found to be superior for predicting any of the educational outcomes. This knowledge gained is significant when considering that students in educational systems are currently being classified according to psychiatric methods (DSM or IDEA). Person-oriented or dimensional methods of classification were found to be able to better predict grade point average, standardized reading achievement measures, number of days absent, number of visits to the opportunity room, and number of suspensions than psychiatric classification methods.

While the ability of person-oriented, dimensional, and psychiatric classification methods to predict educational outcomes is still questionable, these results indicate the relative superiority of person-oriented and dimensional methods of classification over the frequently used psychiatric methods. This study was limited in the availability of behavioral outcomes, which would be hypothesized to be more highly correlated with classification systems utilizing teacher ratings of emotional and behavioral functioning. Additionally, the validity of some of the outcome measures, particularly number of suspensions, is questionable due to the fact that they are based on complex teacher and school processes beyond the child's problems. Despite limitations, these results are consistent with previous research suggesting the inadequacies of current psychiatric classification methods. Furthermore, it should be emphasized that the present findings point to the need for future research into alternative classification methods for use in school age children. Particularly, methods utilizing a person-oriented or dimensional approach to classification should be further investigated.

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CHAPTER 3

CONCLUSIONS

The purpose of this study was to compare methods of classification for use in predicting school based outcomes. Specifically, the advantages and disadvantages of psychiatric, dimensional, and person-oriented methods of classification were presented. The relative superiority of these methods in predicting school-based outcomes was examined through the use of regression analyses and T tests to compare the differential predictive validity of the three classification systems. Overall results suggested that these classification methods were not optimal for predicting educational outcomes. However, differences among the classification methods existed. Despite limitations, the results of the current study suggest that the current psychiatric method of classification is inferior to both dimensional and person-oriented methods. This finding is highly consistent with the review of the literature suggesting that psychiatric methods, such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) and the Individuals with Disabilities Education Act (IDEA), are inadequate for accurate classification and diagnosis of childhood disorders. While the inadequacies of the DSM have been duly stated in the past few studies have offered more than a critique. This study not only challenged the current views on classification it also offers insight into a promising future direction for classification research; namely, utilization of person-oriented or dimensional approaches to classification.