

EXPRESSIVE LANGUAGE ABILITY AS A PROSPECTIVE PREDICTOR OF  
EXTERNALIZING BEHAVIORS: PROFILES OF PRESCHOOL-AGED  
CHILDREN'S ATTRIBUTES AS MODERATING INFLUENCES

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## ABSTRACT

Relations between preschool-aged children's expressive language ability and externalizing behaviors remain poorly understood and may be moderated by other influences, including child sex, temperamental anger/frustration, receptive language, and adaptive communication skill (i.e., "real-world" usage of language). The present study used person- and variable-centered approaches to (a) identify meaningful classes of children based on these attributes, and (b) test for class-specific differences in the relation between expressive language and later externalizing behaviors. Participants were 144 preschool-aged children ( $M = 47.43$  months; 51% male) who were recruited from semi-rural Head Start centers and assessed at two time points, approximately five months apart.

Latent class analysis identified three classes of children: (a) the Typical Language/Higher Anger class (average language/communication abilities and higher anger/frustration), (b) the High Communication/Average Anger class (only female children with high adaptive communication and otherwise average attributes), and (c) the Verbally Competent/Lower Anger class (high language/communication abilities and lower anger/frustration). Expressive language negatively predicted Time 2 externalizing behaviors more strongly among the High Communication/Average Anger class, compared to the Typical Language/Higher Anger class. Across the entire sample, there was a negative predictive relation between expressive language and Time 2 externalizing behaviors, which was moderated by anger/frustration and adaptive communication. Overall, among children with competent skills in expressive language and at least one additional domain (e.g., higher adaptive communication, lower anger/frustration), higher

expressive language more strongly predicted lower levels of Time 2 externalizing behaviors, relative to children with fewer concurrent competencies. Higher levels of expressive language were not related—or were less strongly related—to later externalizing behaviors among children with fewer concurrent competencies. Results underscore the proximal role of temperamental and adaptive communicative attributes in supporting expressive language usage and suggest different intervention strategies for children with different configurations of attributes.

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## CHAPTER 1 INTRODUCTION

The co-occurrence of externalizing behavior problems and language difficulties among children has been well-documented in literatures spanning the fields of child psychology, psychiatry, education, and speech-language pathology (Gallagher, 1999). Elevated rates of externalizing behavior problems have been reported among children with language delay or disorders (Horowitz, Westlund, & Ljungberg, 2007; van Daal, Verhoeven, & van Balkom, 2007; Willinger et al., 2003), as well as high rates of linguistic difficulties among children who meet diagnostic criteria for psychological disorders (Cohen et al., 1998; Ripley & Yuill, 2005). For example, a review of 26 studies revealed that 71% of children with emotional/behavioral problems experienced clinically significant language difficulties, and 57% of children with language difficulties also evidenced clinically significant emotional/behavioral problems (Benner, Nelson, & Epstein, 2002). Understanding the co-development of linguistic impairment and behavior problems in early childhood thus has important clinical implications, given their prevalence and associated outcomes.

### *Correlates and Sequelae of Co-occurring Language and Behavior Problems*

Considered separately, clinically significant behavior problems are estimated to affect 10% to 15% of preschool-aged children (Campbell, 1995). Other estimates suggest that nearly 17% of preschool-aged children meet criteria for oppositional defiant disorder and 20% experience moderate levels of externalizing symptoms (Lavigne et al., 1996; Pianta & Caldwell, 1990). Although some children evidence decreases in externalizing behaviors over time, nearly 20% of children with initially moderate or high levels of

aggressive behavior follow a fairly stable course, with negative outcomes (e.g., social maladjustment, academic problems) apparent at twelve years of age (Campbell, Spieker, Burchinal, & Poe, 2006). Externalizing behavior problems are associated with additional maladaptive correlates, including peer rejection, social skill deficits, academic difficulties, and high rates of expulsion and suspension from preschool and day care (Gilliam & Shahar, 2006; Qi & Kaiser, 2003).

Estimates of language delay in young children range from 12.5% to 15% among older infants and toddlers and 18% to 28% among 30- to 39-month-olds (Horwitz et al., 2003). In one study, more than 25% of contextually disadvantaged preschool-aged children had language scores at least 1.3 *SDs* below the mean (Kaiser, Cai, Hancock, & Foster, 2002). Children with early language difficulties experience long-term adverse outcomes, including demoralization, higher levels of grade retention, and lowered academic performance, even subsequent to the resolution of their language problems (Benner et al., 2002; Catts, 1993; Harrison, McLeod, Berthelsen, & Walker, 2009; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006).

As a broad overview, receptive language impairment refers to difficulties in the comprehension of language, whereas expressive language impairment involves difficulties in the production and the structural use of language (Owens, 2001). Language difficulties or disorders may be solely receptive or expressive in nature, or a mixture (i.e., mixed-expressive language disorder). Speech difficulties are considered to be distinct from language disorders and refer specifically to disruptions in verbal communication, including articulation difficulties (Owens, 2001).

During the preschool period, emotional and behavioral problems are reliably and

positively associated with language difficulties (Beitchman, Hood, Rochon, & Peterson, 1989; McCabe, 2005; Qi & Kaiser, 2004; Stanton-Chapman et al., 2007; Willinger et al., 2003), with more severe behavioral problems noted among children with receptive or pervasive language difficulties, compared to expressive language impairment (Beitchman et al., 1996; Benner et al., 2002; Botting & Conti-Ramsden, 2000; Estrem, 2005; Tervo, 2007; van Daal et al., 2007). McCabe (2005) found that children with global language delays, with and without articulation difficulties, demonstrated more impaired behavioral functioning than children with delays in expressive language and/or articulation. In Beitchman and colleagues' study of three subgroups with different patterns of language impairment (i.e., low overall, poor auditory comprehension, and poor articulation), the low overall and poor comprehension groups were associated with more severe impairments in behavioral functioning, both concurrently (Beitchman et al., 1989) and at 7-year follow-up (Beitchman et al., 1996). Among early school-aged children, expressive-only impairment was associated with significantly fewer social or behavioral problems than receptive or mixed receptive-expressive impairment (Botting & Conti-Ramsden, 2000). Similarly, Tervo (2007) reported that children with no language delay had the highest scores on a developmental inventory assessing adaptive, social, motor, language, and pre-academic functioning, followed by children with expressive-only delays, then children with receptive-only delays, and, finally, children with mixed receptive-expressive impairments.

Preschool-aged children with language difficulties are more likely to evidence deficits in social skills (Qi & Kaiser, 2004; Stanton-Chapman et al., 2007). Indeed, children with specific language impairment appear more isolated in the classroom, have

fewer peer relationships, and are less satisfied with their peer relationships, compared to their same-age peers (Craig, 1993; Fujiki, Brinton, & Todd, 1996; McCabe, 2005).

Children with typical language tend to be the preferred addressee in peer interactions (Rice, Sell, & Hadley, 1991); consequently, peers are less likely to seek out children with language impairments for conversations. In addition, children with speech or language impairments demonstrate a stronger preference to initiate conversations with adults and tend to provide shorter or nonverbal responses, compared to their peers with typical language abilities (Rice et al., 1991). Even when children with language or speech impairments are addressed by peers (Hadley & Rice, 1991) and adults (Bishop, Chan, Adams, Hartley, & Weir, 2000), they tend to respond less frequently than peers without language impairments. Lack of participation in pretend play and other language-promoting activities may result in children's lagging behind socially as well, which would further impair their ability to initiate and participate in verbal interactions with peers. In addition, children with specific language delays demonstrate fewer cooperative conflict resolution strategies (Stevens & Bliss, 1995) and are often excluded by peers (Craig, 1993), thus further exacerbating their social-linguistic delays and increasing the likelihood that they will engage in aggressive or disruptive behaviors to achieve their interpersonal goals (Coie & Kupersmidt, 1983).

During the preschool period, children with both language impairment and behavior problems are less likely to outgrow their language disorder (Fischel, Whitehurst, Caulfield, & DeBaryshe, 1989; Olswang, Rodriguez, & Timler, 1998), suggesting that behavior problems, once present, can interfere further with language development. Indeed, behavior problems reliably elicit negative reactions from the social environment

and may promote the development of new problem areas (e.g., peer rejection; Patterson, 1993). Thus, behavior problems may further maintain poor language skills, as well as preclude children from having important social experiences and positive language-based interactions that could buffer them from the risk of additional maladaptation.

### *Limitations in the Literature*

Given that both language difficulties and externalizing behaviors are associated with negative correlates and sequelae, understanding the developmental relations between language and externalizing behaviors could inform etiological and intervention models at a time when these processes are amenable to intervention. Currently, the potential mechanisms underlying this relation are not well understood. At least three explanations have been proposed for their co-occurrence (Carpenter & Drabick, 2010; Dionne, Tremblay, Boivin, Laplante, & Perusse, 2003; Schoenfeld, Shaffer, O'Connor, & Portnoy, 1988; Willinger et al., 2003). First, language difficulties may confer risk for behavior problems. For example, children may react with frustration and engage in problematic behaviors when they are unable to communicate effectively with others. In support of this explanation, several studies have reported that earlier language risk predicts subsequent behavioral difficulties (Beitchman et al., 1996, 2001; Brownlie et al., 2004; Fagan & Iglesias, 2000; Hooper, Roberts, Zeisel, & Poe, 2003). Second, behavior problems may interfere with the development and acquisition of developmentally relevant language abilities and thus contribute to language difficulties. Third, the association between behavior problems and language difficulties may stem from shared etiologies or risk processes (Gilliam & de Mesquita, 2000).

Nevertheless, it is unlikely that there is a single explanation for the causal

mechanisms underlying the co-occurrence of language difficulties and externalizing behavior problems (Stevenson, 1996). Indeed, there may be *subgroups* within the larger population for whom language-behavior relations are particularly strong, weak, or nonexistent, depending on the presence of moderating variables. Rather than ascertaining which of these explanations is most valid, a developmental psychopathology perspective suggests that research should seek to understand the circumstances under which different explanations are valid for different children (Carpenter & Drabick, 2010).

Unfortunately, several methodological issues make the detection of a more nuanced pattern of associations between language and externalizing behaviors difficult. First, previous studies have primarily relied on variable-centered analytic approaches (e.g., regression analyses) to address related research questions. Person-centered strategies can aid in the identification of relatively homogeneous, qualitatively distinct subgroups of individuals who may evidence different developmental patterns among variables, whereas variable-centered strategies assume that all individuals in a sample follow a similar pattern of development (Magnusson, 1998). Unlike variable-centered approaches, which examine variables in isolation, person-centered approaches account for separate configurations of variables, such that no one variable necessarily carries the same predictive power across all members of a sample. A combination of variable- and person-centered approaches is useful for research efforts aimed at understanding language-externalizing behavior relations; this combined approach can facilitate (a) the identification of meaningful subgroups of children with distinct configurations of characteristics (person-centered), and (b) an examination of subgroup-specific relations between variables (variable-centered).

Second, the extent to which studies have controlled for potential confounding variables has been inconsistent. In several samples, the relation between language and behavioral symptoms has been attenuated after controlling for overall cognitive functioning (Gilliam & De Mesquita, 2000) and after excluding participants with neurodevelopmental delays or pervasive developmental disorder (Rescorla et al., 2007). Although several studies have restricted participant inclusion based on children's nonverbal IQ scores (e.g., Fischel et al., 1989; Stanton-Chapman et al., 2007; van Daal et al., 2007), few studies have statistically controlled for overall IQ scores to partial out associated variance. Moreover, not all studies specifically address the developmental status of participants in the sample.

Third, with a few exceptions (e.g., Beitchman et al., 2001), studies have been primarily cross-sectional in nature and thus cannot provide information about the direction of change in constructs over time. Fourth, researchers often examine relations between behavior problems and language difficulties using either language-delayed or behavior-disordered samples (McCabe, 2005). Although this strategy can inform understanding of processes among high-risk children, this approach provides less information about the relations between language and behavior problems for typically developing children and high-risk community samples (Qi & Kaiser, 2004). A related limitation is that a reliance on clinical samples has maintained a deficit-oriented research lens, which makes it more difficult to detect factors associated with resilience among children who are at risk for behavior and language problems due to economic disadvantage (Bowman et al., 2006).

Finally, subtypes of language delay/impairment (i.e., expressive, receptive, mixed

expressive-receptive, pragmatic) are frequently collapsed within studies and discussed as general “language impairment” (e.g., Brownlie et al., 2004; for an exception, see Beitchman et al., 1996) or combined with speech/articulation difficulties (e.g., McCabe, 2005). As noted earlier, estimates of the co-occurrence of language and behavioral problems vary widely according to the subtype or combination of language impairments examined; thus, collapsing language delay/impairment subtypes precludes a more precise understanding of the roles of different aspects of language (i.e., expressive vs. receptive language). In particular, expressive language has been understudied relative to receptive language or general language impairment, with only a few studies specifically examining expressive language as an independent predictor of externalizing behaviors.

#### *Expressive Language and Behavior Problems*

Overall, comparisons of children with expressive language delays vs. other language difficulties have suggested less significant behavioral impairment among children with expressive language delays (e.g., Botting & Conti-Ramsden, 2000), as well as null results (Willinger et al., 2003). However, in one study among early school-aged children, expressive language was concurrently related to teacher-rated behavior problems, but this relation did not remain statistically significant in longitudinal analyses (Hooper et al., 2003). In another study, concurrent associations between expressive language and behavior problems were reported among school-aged and adolescent boys (Ripley & Yuill, 2005). In terms of evidence for prospective relations, communicative competence prospectively predicted end-of-year behavioral functioning among low-income preschool children, although expressive language *per se* was not assessed (Fagan & Iglesias, 2000). Overall, results of these studies suggest that the nature of the relation

between expressive language and behavior problems is unclear. Conclusions are further limited by several of the methodological issues described above (e.g., variable-centered analytic methods).

Weak and/or inconsistent findings in the literature belie expressive language's conceptual importance as a risk or protective factor in predicting externalizing behaviors. According to social development theories (Luria, 1960, 1961; Vygotsky, 1962), the development of speech ultimately forms the basis for children's self-regulatory abilities by providing the means to plan, monitor, and organize behavior. During the preschool period, children first use overt speech (internal representations of parental commands), which later becomes internalized into private speech (Luria, 1982). It has been proposed that use of private speech allows children to ignore immediate competing environmental demands, to react less impulsively, and to increase mastery over behavior (Díaz, Neal, & Amaya-Williams, 1992).

Consistent with these theoretical arguments, several studies have found an association between language and self-regulatory processes that involve a higher level of attentional control (Kaler & Kopp, 1990; Kopp, 1989). Language ability is correlated with indices of executive function (e.g., working memory, rule-guided planning) among toddlers (Carlson et al., 2004; Hughes & Ensor, 2005) and older preschool children (Blair, 2003; Carlson et al., 2004; Müller, Zelazo, & Imrisek, 2005). Lower levels of expressive language may confer risk for externalizing behaviors by limiting children's ability to label emotions, identify appropriate behavioral and emotion regulation strategies, and flexibly solve problems (Carpenter & Drabick, 2010; Cole, Dennis, Smith-Simon, & Cohen, 2009; Greene & Doyle, 1999). Each of these skill deficits may increase

children's likelihood of engaging in disruptive behavior when faced with difficulties communicating verbally (Dionne et al., 2003), while further decreasing their ability to participate in language-rich social and academic interactions (Carpenter & Drabick, 2010).

Among preschool-aged children, development of expressive language and other verbal competencies is critical for early school success. School entry represents a significant developmental milestone for preschoolers, who must form new relationships outside of the family, adjust to the expectations of teachers and classroom routines, follow directions, and interact with peers during learning and play (Mendez, Fantuzzo, & Cicchetti, 2002; Olson & Hoza, 1993). Children's linguistic and communicative development forms the basis for meta-communication about play, planning for play, and the execution of complex social pretend play (Howes & Lee, 2006), including peer cooperation during play (Brownell, Ramani, & Zerwas, 2006).

In keeping with these sophisticated verbal demands, language development during the preschool period is characterized by the production of longer and more complex sentences. By age 3, typically developing children can use language to describe more abstract concepts, such as internal states and relationships (Berk, 2002), and add grammatical morphemes that contribute increased structural and semantic complexity (e.g., "-ing" verb endings, simple prepositions, plural nouns; de Villiers & de Villiers, 1973). Questions, negatives, embedded sentences, and connectives joining two clauses also appear in preschool-aged children's increasingly complex speech. By the end of the preschool years, children are able to use most grammatical structures correctly. Given the increasing importance of expressive language development during the preschool years, a

greater and more specific focus on expressive language is warranted to clarify its role in the prediction of later externalizing behaviors. In particular, likely heterogeneity among children with co-occurring language and behavior problems suggests the need to understand moderating influences on the relations between expressive language and later behavior.

### *Conceptual Model of Relevant Moderating Variables*

The identification of variables hypothesized to moderate the relation between expressive language and externalizing behaviors was guided by core developmental psychopathology principles emphasizing (a) an understanding of typical development and (b) risk and protective factors drawn from multiple domains. For the current study, profiles of children's attributes were based on child sex and linguistic, communicative, and temperamental attributes that likely interact to confer risk for or resilience from externalizing and/or expressive language difficulties (Hebert-Myers, Guttentag, Swank, Smith, & Landry, 2006; Mendez et al., 2002; Paul & Fountain, 1999; Roulstone, Peters, Glogowska, & Enderby, 2003). More specifically, receptive language, adaptive communication, temperamental anger/frustration, and child sex were considered to be conceptually relevant moderating variables.

#### *Receptive language*

As noted earlier, low levels of receptive and expressive language skills carry differential levels of risk for poor outcomes, with low receptive language and/or mixed receptive-expressive difficulties associated with more severe behavioral outcomes than expressive-only difficulties. Thus, children with competent receptive language skills may evidence more resilient outcomes, even in the context of other risk factors, whereas poor

receptive language may increase the likelihood of developing co-occurring language and behavior problems. For example, language-impaired children with higher levels of receptive language skills are less likely to experience disruptions in peer interactions (Craig, 1993), which may allow language-impaired children to gain some experience with navigating peer relationships. These findings suggest that it is important to consider children's receptive and expressive language abilities simultaneously, given that children's particular patterns of language development may have distinct links to their behavioral outcomes.

### *Adaptive communication*

Despite some documented associations between expressive language difficulties and behavioral problems, children's expressive language ability measured in a controlled testing situation may not correspond directly to their ability to communicate in everyday situations. Children's levels of "adaptive communication"—which I have operationalized to denote "real-world" usage of language to convey one's needs, feelings, and goals (Carpenter & Drabick, 2010)—may provide additional information about children's linguistic functioning that is not captured by standardized language testing scores. For example, children with intact expressive language but low levels of adaptive communication may be less able to use their linguistic knowledge to navigate interpersonal challenges in the classroom, thus making it more likely that they will act out behaviorally. Conversely, children with below-average expressive language ability but appropriate adaptive communication may be able to apply words that they know appropriately to express their goals or wishes in various situations. Adaptive communication skills may help children to compensate for deficits in structural language

skills and to avoid or minimize their experience of other negative sequelae.

Consequently, children with higher levels of adaptive communication may be at decreased risk for behavioral problems relative to children with lower levels of adaptive communication.

In support of this possibility, higher levels of baseline adaptive communication skills predicted improved outcomes among young children with early speech/language delay who were monitored over a one-year period (Paul & Fountain, 1999; Roulstone et al., 2003). Also, several studies have demonstrated that behavior problems can be reduced through the provision of training in adaptive communication skills (for a review, see Miranda, 1997). For example, Vollmer and colleagues (1996) identified the function of tantrums among three language-delayed children (aged 2 to 4 years; e.g., maternal attention, access to preferred toys). They used this information to teach more adaptive communicative replacement behaviors to the children, whose tantrums subsequently decreased (Vollmer, Northup, Ringdahl, LeBlanc, & Chauvin, 1996). Thus, adaptive communication may be an important protective factor to include in a conceptual model of comorbidity, as higher levels may buffer the development of behavior problems among children with language difficulties.

#### *Temperamental anger/frustration*

Temperamental anger/frustration is considered to fall under the broader temperament constructs of difficult temperament and negative emotionality (Bates, 1980; Prior, 1992; Rothbart, Ahadi, Hershey, & Fisher, 2001). Among infants, direct links have been established between behavior problems and anger (Szabó et al., 2008) and impulsivity and anger (Karreman, de Haas, van Tuijl, van Aken, & Deković, 2010).

Among preschool-aged children, proneness to anger is associated with externalizing behavior problems (Eisenberg et al., 2001; Hayden, Klein, & Durbin, 2005; Rothbart et al., 2001; Rothbart, Derryberry, & Hershey, 2000) and low levels of prosocial behaviors (Denham, 1986).

With regard to children's language development, lower levels of linguistic mastery have been reported among children with difficult temperaments (Dixon & Shore, 1997; Dixon & Smith, 2000; Noel, Peterson, & Jesso, 2008; Slomkowski, Nelson, Dunn, & Plomin, 1992). Researchers have hypothesized that more flexible and easygoing temperamental styles promote parent-child interactions that are conducive to learning words and allow parents to scaffold their children's emerging language skills (Noel et al., 2008).

Lower levels of temperamental anger/frustration may buffer the development of co-occurring expressive language and externalizing difficulties. Children who are prone to experience anger/frustration and have lower thresholds for strong emotional reactions are more likely to engage in disruptive behaviors, and thus, less likely to use verbally mediated problem-solving strategies, when their goals are blocked or when they feel challenged (Eisenberg et al., 2005; Frick & Morris, 2004; Keenan & Shaw, 1997; Muris & Ollendick, 2005). This type of reactive emotional responding—although reinforcing in the short term—precludes children from learning alternative strategies for responding to challenging situations, potentially contributing to problematic relationships and difficulty participating in social and academic situations (Carpenter & Drabick, 2010; Dodge, Greenberg, Malone, & Conduct Problems Prevention Research Group, 2008). In support of this possibility, frustration tolerance moderated the relation between language delay

and acting-out behaviors among urban African-American kindergarten children, such that children with higher frustration tolerance evidenced fewer problematic behaviors in the context of general language risk (Bowman et al., 2006). In another study, early school-aged children with specific language impairment had lower levels of emotion regulation abilities and higher levels of emotional negativity/lability, compared to their typically developing peers (Fujiki et al., 2002).

#### *Child sex*

Effects of child sex on language-behavior relations have not been systematically studied in the literature. Several studies have reported a stronger association between behavior problems and language difficulties among boys (Lundervold, Heimann, & Manger, 2008; Stowe, Arnold, & Ortiz, 1999; Tallal, Dukette, & Curtiss, 1989), whereas another reported an association only among girls (Olson & Hoza, 1993). It is possible that processes underlying the development of comorbidity may vary by sex, especially given (a) higher rates of behavior problems and language difficulties among boys (Campbell, 2002; Horwitz et al., 2003), and (b) sex differences in interrelations among other risk factors for behavior problems (Blatt-Eisengart, Drabick, Monahan, & Steinberg, 2009). It also is possible that girls may exhibit less overtly disruptive forms of externalizing behaviors or fewer apparent language difficulties (Stowe et al., 1999). The empirical literature has not provided sufficient evidence to inform separate models among boys and girls; therefore, it is important to include child sex as a moderating influence in order to examine whether boys and girls differ in language-behavior relations when other relevant variables are taken into account.

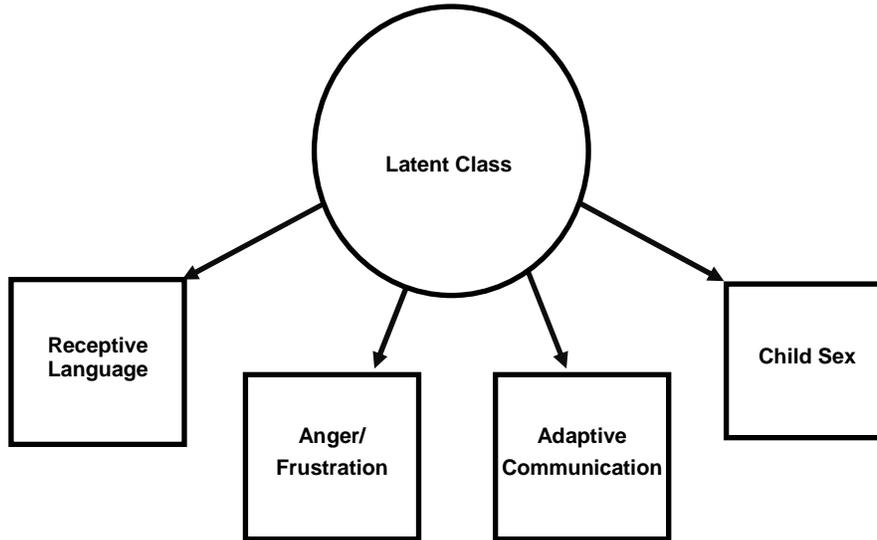
### *The Current Study*

To address heterogeneity in the relations between expressive language and later externalizing behavior problems, I used person- and variable-centered analytic strategies to (a) identify latent classes of hypothesized moderating attributes on the prospective relation between preschoolers' expressive language and externalizing behaviors, and (b) test for class-specific differences in this relation. I considered child sex, receptive language, adaptive communication, and temperamental anger/frustration as indicators of latent class membership. These latent class indicators, together with expressive language and nonverbal cognitive ability, were assessed at the beginning of the academic year (Time 1), and teacher-reported levels of externalizing behaviors were assessed at both Time 1 and Time 2 (end of the academic year). I specifically sought to address methodological limitations in the literature by (a) using a prospective design, (b) accounting for the influence of potentially confounded variables (e.g., cognitive ability), (c) using dimensional indicators of language and behavioral competencies, and (d) using a high-risk community sample of preschool-aged children who attend Head Start. Economically disadvantaged children are at risk for developing behavioral problems (Duncan, Brooks-Gunn, & Klebanov, 1994; Kaiser, Hancock, Cai, Foster, & Hester, 2000; Lavigne et al., 1996; Qi & Kaiser, 2003) and language delays or impairments (Champion, Hyter, McCabe, & Bland-Stewart, 2003; Kaiser et al., 2002; Qi & Kaiser, 2004). Thus, examining the relations between expressive language and behavior among economically disadvantaged children permits evaluation of youth with variable language and behavioral functioning and has potential implications for early intervention efforts among at-risk and disadvantaged children.

*Hypothesis 1: Latent Profiles of Moderating Influences on Children's Expressive Language-Behavior Relations*

To examine this hypothesis, I considered four latent class indicators: child sex, receptive language, anger/frustration, and adaptive communication (Figure 1). I expected that a four-class model of children's moderating attributes would fit the data best. The first class was hypothesized to consist predominantly of male children with relatively low levels of receptive language and adaptive communication, and high temperamental anger/frustration, given McCabe's (2005) findings of a cluster of children with global language and social-emotional impairments (Subgroup 1). Both the second and third classes were hypothesized to consist of children with average comprehension; however, Subgroup 2 was expected to have higher adaptive communication skills and lower anger/frustration levels, whereas Subgroup 3 was hypothesized to exhibit lower adaptive communication skills and higher anger/frustration. Finally, a fourth group was expected to include predominantly female children with cross-domain competence, including above average receptive language and communicative skills and lower levels of anger/frustration (Subgroup 4).

Figure 1. *Latent Class Model*

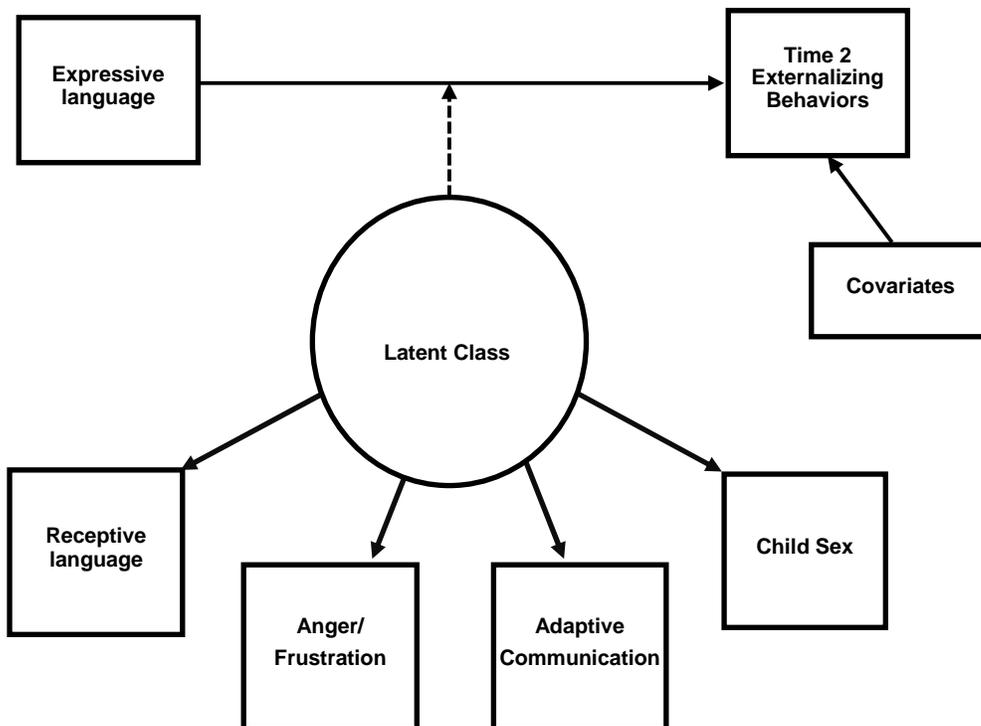


*Hypothesis 2: Differential Predictive Relations between Expressive Language and Time 2 Externalizing Behaviors by Latent Class*

Class-specific relations between expressive language and later externalizing behaviors were tested in the study's second hypothesis (Figure 2). After controlling for relevant covariates, it was expected that given higher levels of expressive language, children with greater concurrent linguistic/communicative impairments would evidence the most significant decreases in Time 2 externalizing behaviors. This hypothesis was grounded in the notion that expressive language abilities would be particularly important among these children for scaffolding relative or absolute weaknesses in receptive language, communication, and temperamental anger/frustration. Therefore, expressive language ability was hypothesized to predict change in end-of-year externalizing behaviors most strongly among Subgroup 1 ("at-risk" in terms of all variables), although a significant relation also was expected for Subgroup 3 (lower levels of adaptive

communication and higher anger/frustration). In Subgroups 2 and 4, average to competent receptive language and adaptive communication, coupled with lower levels of anger/frustration, were expected to provide adequate buffers against the development of externalizing behaviors, even in the context of lower levels of expressive language. Thus, the relation between expressive language and externalizing behaviors was expected to be relatively weak and/or absent among Subgroups 2 and 4.

Figure 2. *Differential Relations between Expressive Language and Time 2 Externalizing Behaviors by Latent Class*



## CHAPTER 2 METHOD

### *Participants*

Participants were 144 English-speaking, preschool-aged children and their primary caregivers, who were recruited from four different Head Start centers located in semi-rural areas of New Jersey. Children were assessed at the beginning and end of the academic year. At the time of initial testing, children ranged in age from 36 to 61 months ( $M = 47.42$ ,  $SD = 7.54$ ). Males comprised 51% of the sample. Caregivers identified approximately 43% of children as African American, 22% as Caucasian, 21% as biracial/multiracial, 10% as Latino, and 4% as Asian American.

The majority of caregiver respondents were biological mothers (90%), although other caregivers also were represented, including biological fathers (4%), both biological parents (3%), adoptive or foster mothers (2%), and grandmothers (1%). Parental marital status was predominantly either single (48%) or married (39%); the rest were divorced (8%), separated (4%), or widowed (1%). More than 36% of caregivers had received a high school diploma or general equivalency degree, an additional 32% had attended some college, and 10% had completed vocational training. Eleven percent of caregivers reported an educational level below eleventh grade, 5% had received a bachelor's degree, and 6% had received at least some graduate education. With regard to employment status, 33% were employed full-time, 20% were employed part-time, 25% were looking for work, and 22% did not work outside the home. Mean annual income was \$22,081 ( $SD = \$16,616$ ; range = \$2,052 – \$96,000).

### *Procedure*

The study was approved by the Temple University Institutional Review Board.

After obtaining permission to recruit families from the Head Start center directors, a description of the study and a consent form were sent to primary caregivers of all preschoolers in four Head Start centers. In addition, research staff attended monthly parent meetings and new-family orientation sessions to introduce the study and to provide an opportunity for caregivers to enroll. Once informed consent was obtained, study questionnaires were either sent home to caregivers or completed at the center.

Inclusion criteria for children's participation were (a) English language fluency, and (b) nonverbal IQ standard score  $\geq 70$ . Children were excluded if they had diagnosed or suspected autism or pervasive developmental disorder (PDD), or if they had a history of significant developmental delay. These criteria were assessed using a two-step eligibility process: (a) review of parent-reported developmental history and consultation with Head Start teaching and special education staff, and (b) child IQ testing.

Enrollment occurred in the fall of 2008 and fall of 2009. Of the 164 children screened over both years, 144 were enrolled in the study (87.8%). Of these 144 participants, 49 children were enrolled in 2008 (34% of total sample), and 95 children were enrolled in 2009 (66% of total sample). Children were excluded from participation because of non-fluency in English ( $n = 10$ ), atypical developmental history or PDD diagnosis ( $n = 7$ ), or withdrawal from Head Start prior to completion of child testing ( $n = 2$ ).

Children were assessed at two time points during the academic year, on average 5.80 months ( $SD = 0.85$ ) apart. At the first time point (Time 1), following informed consent, parents completed questionnaires related to their child and family, including ratings of their children's temperamental anger/frustration. Children provided verbal

assent and participated in nonverbal cognitive testing, followed by receptive and expressive language testing. Teachers completed ratings of children's externalizing behaviors and adaptive communication. At the second time point (Time 2), teachers again rated children's externalizing behaviors. Parents and teachers were compensated for their time, and children received a small gift at each time point.

### *Measures*

*Demographics.* Parents completed a questionnaire asking them to supply the following information about themselves: date of birth, ethnicity, current marital status, employment status, relationship to the Head Start child, number of children and adults in the home, and annual income. Parents also provided the date of birth, sex, and ethnicity of their child enrolled in Head Start.

*Developmental history.* Parents completed the Child Background Questionnaire, which assessed pregnancy history and the child's birth history, language and motor development (including achievement of specific developmental milestones), hearing and vision, and behavioral concerns. Parents also indicated whether health professionals had ever expressed concerns related to autism or PDD, language delay, and/or developmental delay. Finally, parents reported on the child's experience of head injury or loss of consciousness, health problems that could affect language or behavior problems, and whether the child has received or was receiving special educational services. Head Start staff and the special education coordinator were consulted if parents' responses indicated (a) both language and motor developmental delay, (b) concern for autism or PDD, (c) hearing or vision issues, (d) medical problems.

*Child externalizing behaviors.* Teacher-reported child externalizing behaviors

were assessed using the Caregiver-Teacher Report form of the Child Behavior Checklist for Ages 1.5 to 5 (C-TRF/1.5-5; Achenbach, 1997), a widely used rating system of children's internalizing and externalizing problem behaviors. This measure has been nationally normed and designed for use by preschool and Head Start teachers, as well as day care staff. The broadband Externalizing subscale *T* score was used in the current study. The C-TRF has acceptable one-year test-retest reliability ( $r = .64$ ), distinguishes between clinical and nonclinical samples, and correlates with independent classroom and clinical ratings (Achenbach, 1997).

*Adaptive communication.* The extent to which children produce meaningful, goal-directed utterances in the classroom setting was measured using the teacher-report Functional Communication subscale of the Behavior Assessment Scale for Children—2<sup>nd</sup> Edition (BASC-2; Reynolds & Kamphaus, 2004). The BASC-2 is a widely used rating system of children's adaptive and problematic behaviors. Teacher-reported scale and composite scores have acceptable internal consistency ( $\alpha s = .75-.96$ ) and test-retest reliability ( $r s = .72-.87$ ) in the preschool age range. Concurrent validity has been established through significant correlations with other established measures, including the Conners' Teacher Rating Scale-Revised (Conners, 1997). Sample items on the Functional Communication scale include, "Is able to describe feelings accurately" and "Communicates clearly."

*Temperamental anger/frustration.* Children's temperamental anger/frustration was measured using the 13-item Anger/Frustration scale of the Children's Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001), which is designed to measure temperament among children aged 3 to 7 years. The Anger/Frustration scale

measures children's negative affectivity in response to the interruption of ongoing activities or blocking of their goals. Parents endorse items based on how true they are in terms of the child's reactions on a scale from 1 (*extremely untrue of your child*) to 7 (*extremely true of your child*). There also was an option of *not applicable*. The item scores were summed and averaged according to how many items were rated by parents. Items included, "Has temper tantrums when s(he) doesn't get what s(he) wants" and "Gets quite frustrated when prevented from doing something s/he wants to do." The Anger/Frustration scale of the CBQ has adequate psychometric properties, including internal consistency ( $\alpha = .80$ ) and interrater reliability ( $r_s = .43-.44$ ). When considered in conjunction with related scales that together comprise the Negative Affectivity global composite, concurrent validity of the scale has been established with significant positive associations with parent-reported aggression and negativity (Rothbart et al., 2001).

*Expressive language ability.* Children's expressive language was assessed using the Expressive Communication scale of the Preschool Language Scale—Fourth Edition (PLS-4; Zimmerman, Steiner, & Pond, 2002). The PLS-4 is an individually administered, norm-referenced test of the language abilities of young children. Test norms are based on a nationwide representative sample of 2,400 children, according to the 2000 US Census figures for children from birth through 6 years of age. Approximately 38% of the standardization sample included ethnic minority children. The use of the third edition of the PLS was supported in other research studies on the language skills of low-income, ethnic minority children who attend Head Start (Qi & Kaiser, 2004; Qi, Kaiser, Milan, Yzquierdo, & Hancock, 2003). Among children 3 to 5 years of age, the PLS-4 authors report test-retest reliability and internal consistency coefficients that range from .92 to .95

for the Expressive Communication subscale. Interrater reliability was excellent ( $r = .99$ ). Criterion validity has been established with the PLS-3 ( $r = .79$ ), as well as a high degree of agreement with the Denver II (100% of children classified as “normal” on the Denver II scored within one standard deviation of average on the PLS-4).

The Expressive Communication subscale is used to assess vocal development, preverbal communication, and the child’s ability to do the following: produce speech sounds, communicate wants and needs, use gestures, name objects, describe pictures and events, speak in grammatically correct sentences, integrate various aspects of language to categorize, complete analogies, provide word definitions, and demonstrate a few phonological awareness skills. Items focus on expressive vocabulary, vocal development, social communication, syntactic knowledge, morphology, semantic knowledge, ability to convey coherent concepts, and integrative language skills.

*Receptive language ability.* The Auditory Comprehension scale of the PLS-4 was administered to assess children’s ability to understand spoken language. Items within the Auditory Comprehension scale measure the child’s understanding of vocabulary (picture-word or picture-phrase matching), syntax, morphology, and semantics, as well as the child’s ability to follow directions (e.g., “Show me your wrist”). For children 3 to 5 years of age, the PLS-4 authors report good test-retest reliability coefficients ( $r_s = .83-.93$ ) and internal consistency coefficients ( $\alpha_s = .83-.94$ ) for the Auditory Communication subscale. In addition, criterion validity has been established with the PLS-3 ( $r = .65$ ).

*Nonverbal cognitive ability.* As a measure of general cognitive ability that is not language-dependent, the Nonverbal Scale from the Kaufman Assessment Battery for Children—2<sup>nd</sup> edition (KABC-II; Kaufman & Kaufman, 2004) was administered to

assess children's processing and cognitive abilities. The Nonverbal Scale yields the Nonverbal Index (NVI), a composite score scaled in standard score units ( $M = 100$ ,  $SD = 15$ ) that is based on four subtests for 3- to 4-year-olds and five subtests for 5-year-olds. The subtests included in the NVI measure children's visual memory and visual processing of social information (Face Recognition subtest), spatial relations (Triangles subtest), sequential processing and short-term memory for motor movements (Hand Movements subtest), classification (Conceptual Thinking subtest), and inductive problem-solving (Pattern Reasoning subtest; 5-year-olds only).

The KABC-II was normed on a sample that closely matched 2001 US census data for the critical factors of race/ethnicity, sex, socioeconomic status (SES), region, and special education status. Scores on the KABC-II appear to be less disparate across ethnic groups than many tests of cognitive ability, including the Wechsler tests (Prifitera, Weiss, & Saklofske, 1998). Specifically, the KABC-II authors report adjusted NVI scores of 100.3 for Caucasian children, 99.7 for Latino/a children, and 96.7 for African American children, after controlling for maternal education (Kaufman & Kaufman, 2004). Internal consistency coefficients for the NVI range from .85 to .91 for three- to five-year-old children. Test-retest reliability is adequate ( $r = .77$ ). Criterion validity of the NVI has been established with the Wechsler Preschool and Primary Scale of Intelligence—Third Edition (WPPSI-III). For three- and four-year-old children, the correlation between NVI and WPPSI-III Performance IQ scores was .70.

### *Statistical Analyses*

#### *Preliminary analyses*

Descriptive statistics were examined for all study variables, and Pearson bivariate

correlations were conducted for all continuous variables. For descriptive purposes, proportions of the sample that could be considered “delayed,” “at-risk,” or “typical” in receptive and/or expressive language domains were calculated, based on Qi and Kaiser’s (2004) suggested cutoff scores. Also, proportions of children with externalizing behavior  $T$  scores in at least the elevated range (i.e.,  $T \geq 60$ ) or the low range (i.e.,  $T \leq 40$ ) were calculated for both time points. Sex differences in mean levels and proportions of study variables were investigated using independent-samples  $t$ -tests. Differences in study variables across Head Start centers were tested using one-way analysis of variance (ANOVA) and chi-square tests. Tukey’s HSD post-hoc test was used to test for the significance of multiple pairwise comparisons.

Across analyses, effect sizes were calculated as a measure of the strength of sample statistics. Cohen (1988) provided guidelines for the interpretation of effect sizes as small ( $d = .20$ ,  $r = .10$ ,  $R^2 = .02$ , partial  $f^2 = .02$ ,  $\omega^2 = .01$ ,  $w = .10$ ); medium ( $d = .50$ ,  $r = .30$ ,  $R^2 = .13$ , partial  $f^2 = .15$ ,  $\omega^2 = .06$ ,  $w = .30$ ); or large ( $d = .80$ ,  $r = .50$ ,  $R^2 = .26$ , partial  $f^2 = .35$ ,  $\omega^2 = .15$ ,  $w = .50$ ).

#### *Missing data*

Data coverage was excellent in the current study and ranged from 94% to 100% on all variables except household income (89%). Two imputation techniques were used to address missing data. Missing covariates were estimated using multiple imputation (MI), which accounts for uncertainty in imputation by creating multiple data sets with plausible imputed values (Schafer & Olsen, 1998). In the current study, 10 datasets were imputed using the statistical software package MPlus 6.1 (Muthén & Muthén, 1998-2010). Results of all subsequent analyses—with the exception of latent class analysis

(LCA)—were integrated across these imputed datasets. With LCA, missing observed indicators were imputed by MPlus using full information maximum likelihood (FIML) estimation. FIML offers an important advantage over MI for imputing variables that determine latent class, because it is not necessary to fit multiple latent class models across imputed data sets. Thus, FIML permits researchers to avoid the possibility of retaining slightly different models across datasets without a logical means of combining results (Collins & Lanza, 2010). Details regarding hypotheses-specific analyses are presented below.

*Hypothesis 1. Latent profiles of moderating influences on children's expressive language-behavior relations*

The first research question of the current study, which aimed to identify qualitatively distinct subgroups of children based on relevant moderating attributes, was addressed using LCA. LCA is a latent variable approach to identifying latent classes of individuals from the observed values of continuous and/or categorical manifest variables, where the latent classes explain the relations among the observed independent variables. The objective of LCA is to find the smallest number of latent classes that can describe the associations among a set of observed variables (Muthén & Muthén, 2000). Individuals are grouped into  $k$  latent classes that are assumed to underlie the data, the number of which is unknown *a priori*.

Using MPlus 6.1 (Muthén & Muthén, 1998-2010), a LCA was conducted based on three continuous variables (i.e., receptive language, anger/frustration, adaptive communication) and 1 dichotomous demographic variable (child sex). The unconditional model was first specified (i.e., 1-class model), and models were then tested iteratively to

identify a solution containing the minimum number of classes possible while achieving adequate model fit. No single statistical index has been identified as the “gold standard” in determining the number of classes to be retained in LCA (Nylund, 2007). Thus, solutions were evaluated based on (a) several information criteria, (b) classification quality, (c) bootstrap likelihood ratio test statistic, and (d) conceptual considerations, including class interpretability and the extent to which classes conformed to *a priori* hypotheses and the extant literature.

*Information criteria.* Information criteria are indices of relative model fit that are used to compare fit across models with different numbers of classes (Nylund, 2007). In the current study, several information criteria were used to evaluate different solutions, namely the Bayesian information criterion (BIC; Schwartz, 1978), sample-size adjusted Bayesian Information Criterion (ABIC; Sclove, 1987), and Akaike Information Criterion (AIC; Akaike, 1974). The information criteria differ in terms of the penalties levied against models with certain characteristics. Specifically, the BIC penalizes larger numbers of parameters and smaller sample sizes, the ABIC penalizes smaller sample sizes, and the AIC penalizes larger numbers of parameters. The model with the lowest value of a given information criterion is preferred, relative to other models.

*Classification quality.* Classification quality also is considered when deciding on the number of classes (Muthén & Muthén, 2000) and is determined through examination of posterior probability information at the individual and class levels. At the individual level, higher probability values indicate greater confidence in an individual’s assignment to a particular class. At the class level, higher probability values provide information about how similar cases are within the group or class. A better fitting solution will have

higher classification rates (i.e., fewer cases that are difficult to classify) for each class, with perfect classification shown by probability values of 1 for each class.

*Bootstrap likelihood ratio test.* The bootstrap likelihood ratio test (BLRT; McLachlan & Peel, 2000) is used to compare fit between  $k$  and  $k-1$  class models. A significant BLRT  $p$ -value for a  $k$  class model indicates a significant improvement in fit over the  $k-1$  class model.

*Conceptual considerations.* Finally, it is important for model selection to be guided by whether the classes make sense theoretically, based on the conceptual model and hypothesized subgroups (Muthén & Muthén, 2000). It is not uncommon for different fit indices to indicate retention of different models (Collins & Lanza, 2010); therefore, conceptual considerations and class interpretability were considered during model selection.

*Follow-up analyses.* For the purposes of between-class comparisons and subsequent analyses, following model selection, children were assigned to the class for which they had the highest conditional probability of membership. Descriptive statistics were computed by latent class. One-way ANOVA and Tukey's HSD post-hoc tests were conducted to compare study variable means across classes. Chi-square analyses were conducted to assess equivalence in categorical variables across latent classes.

*Hypothesis 2: Differential predictive relations between expressive language and Time 2 externalizing behaviors by latent class*

The second research question aimed to test differential prospective predictive relations between expressive language and Time 2 externalizing behaviors according to the latent classes identified. Given that children were clustered within Head Start centers

and cohorts, data nonindependence was first tested to determine the subsequent analytic strategy based on seven groups (Year 1/Centers 1-4 and Year 2/Centers 1- 3).

Nonindependence of data represents a violation of the assumptions of several common analytic strategies, including techniques that fall under the general linear model (Kenny, Mannetti, Pierro, Livi, & Kashy, 2002). The intraclass coefficient (ICC) provides a test of nonindependence by comparing within-group variation to between-group variation.

Nonindependence (i.e., a significant ICC) is indicated when between-group variation significantly exceeds within-group variation (Grawitch & Munz, 2004).

*Testing for nonindependence.* The ICC was calculated according to the ANOVA-based procedures recommended by Grawitch and Munz (2004), Kenny et al. (2002), and—given unequal group sizes—Kenny and La Voie (1985). All of the ICC values were negative, indicating that the groups' members were more dissimilar than similar to each other (Kenny et al., 2002). The ICC values were not statistically significant (all  $p$ s 2-tailed) for Time 1 externalizing scores,  $r_i = -.04$ ,  $F(102, 6) = 2.99$ ,  $p = .16$ ; Time 2 externalizing scores,  $r_i = -.03$ ,  $F(108, 6) = 1.88$ ,  $p = .44$ ; or adaptive communication,  $r_i = -.01$ ,  $F(102, 6) = 1.16$ ,  $p = .94$ . These results suggested that multilevel analytic strategies were not necessary to control for nesting in subsequent analyses. Thus, multiple regression was selected as the analytic tool to test Hypothesis 2.

*Multiple regression analyses.* Separate hierarchical regression analyses were conducted for each class, with expressive language as the predictor and Time 2 externalizing behaviors as the dependent variable. Covariates (i.e., Time 1 externalizing behaviors, nonverbal cognitive ability, child age, household income, and receipt of speech therapy) were entered (controlled for) in the first step, and expressive language

was entered in the second step.

Multicollinearity statistics were examined for all multiple regression analyses and were found to be acceptable. Multicollinearity occurs when two or more variables within a multiple regression model are highly correlated, which can inflate the standard errors of individual predictors and thus, preclude valid conclusions about the role of individual predictors in an overall model (Tabachnick & Fidell, 2007). Two statistics are commonly used to estimate the impact of multicollinearity, namely the tolerance and variance inflation factor (VIF) of individual predictor variables. Tolerance is defined as the proportion of a variable's variance that is not accounted for by the other predictors in the equation; values below 0.10 to 0.20 may indicate multicollinearity (Garson, 2011; Pedhazur, 1997). In the current set of analyses, tolerance values for all variables ranged from 0.59 to 0.97, which do not suggest multicollinearity. In addition, the VIF, the inverse of the tolerance statistic, is a measure of the extent to which the standard error of the regression coefficient is inflated due to multicollinearity. VIF values above 4 to 10 have been proposed as unacceptably high values (Garson, 2011; Pedhazur, 1997). VIF values in the current set of analyses ranged from 1.03 to 1.67, suggesting no significant inflation of the standard error terms of the regression coefficients.

Standardized regression weights and effect sizes corresponding to increases in  $R^2$  were examined for each class. Post-hoc power analyses were conducted using the program G\*Power 3.1.2 (Faul, Erdfelder, Buchner, & Lang, 2009). Results suggested that the power to detect a small-to-medium effect of expressive language on Time 2 externalizing behaviors ranged from 16% to 27% across latent classes. Thus, bootstrapping was employed to increase confidence in the sampling distribution of the

unstandardized regression slope for each class.

*Bootstrapping.* Bootstrapping is a nonparametric inferential technique that provides reliable estimates of the shape of a particular statistic's sampling distribution, even given sample size limitations (Shrout & Bolger, 2002). Bootstrapping draws a large number of alternative resamples of the statistic in question from the original sample, with replacement, such that each resample varies randomly from the original sample. From this new, large set of randomly varying resamples, bootstrapping estimates the statistic's sampling distribution based on its relative frequency distribution in the resamples. In the current study, bootstrap 95% confidence intervals were calculated for the unstandardized regression slope of each latent class, based on 1000 resamples.

*Post-hoc variable-centered analyses: Expressive language's conditional and interactive effects on Time 2 externalizing behaviors*

Post-hoc variable-centered analyses were conducted for the entire sample to determine (a) the effect of expressive language on Time 2 externalizing behaviors, and (b) the moderating influences on this relation. Specific model configurations are discussed below. Multicollinearity statistics were examined and found to be acceptable. Tolerance values ranged from .40 to .92, and VIF values ranged from 1.09 to 2.45.

*Prospective and concurrent relations between expressive language and externalizing behaviors.* To examine whether expressive language predicted Time 1 and/or Time 2 externalizing behaviors across the entire sample, a hierarchical multiple regression analysis was conducted. Receptive language, nonverbal cognitive ability, adaptive communication, child sex, child age, household income, receipt of speech therapy, and Time 1 externalizing behaviors (in the prospective analysis only) were

entered as covariates in Step 1, and expressive language was entered in Step 2. Power analyses indicated 40% power to detect a small effect of expressive language and 99% power to detect a medium effect for both Time 1 and Time 2 externalizing behaviors.

*Interactive effect of expressive language and latent class indicators on Time 2 externalizing behaviors.* To test the moderating influences of certain latent class indicators on the relation between expressive language and Time 2 externalizing behaviors, several three-way interactions were tested: (a) expressive language, anger/frustration, and adaptive communication; (b) expressive language, anger/frustration, and child sex; and (c) expressive language, adaptive communication, and child sex. For all analyses, Step 1 covariates included Time 1 externalizing behaviors, nonverbal cognitive ability, child age, household income, and receipt of speech therapy. Child sex, adaptive communication, receptive language, and anger/frustration also were entered in Step 1 for those analyses that did not include these variables in the three-way interaction. Conditional variables were entered in Step 2, all three two-way interaction terms were entered in Step 3, and the three-way interaction term was entered in Step 4. To minimize multicollinearity, the independent variables were centered ( $M = 0$ ) and the centered variables were used to create the interaction terms before inclusion in the regression equation (Aiken & West, 1991).

For significant interaction terms, post-hoc probing of moderational effects was conducted according to Preacher, Curran, and Bauer (2006). Their procedure calculates simple intercepts, simple slopes, and the statistical significance of these parameters, as well as coordinates at certain values of the predictor and moderating variables. These values were computed based on the regression weights of the intercept, conditional

variables, and interaction terms; the asymptotic variances of the regression coefficients; and the asymptotic covariances of certain regression coefficient pairings. Calculations yielded unstandardized betas (slopes) and intercepts for children with the four combinations of low (1 *SD* below the mean) and high (1 *SD* above the mean) levels of the continuous moderating variables, or the four combinations of child sex and low/high levels of the continuous moderator. These four regression equations were plotted using conditional values of the moderating variables at low (1 *SD* below the mean) and high (1 *SD* above the mean) levels of expressive language. To test for significant differences between simple slopes, slope difference testing was conducted according to calculation procedures developed by Dawson and Richter (2006).

## CHAPTER 3 RESULTS

First, descriptive statistics are presented to provide information about sociodemographic variables, language and behavioral functioning, and latent class indicators across the sample. Second, results of the LCA and subsequent model selection process are discussed. Third, class-specific variable-centered analyses are presented. Finally, additional variable-centered results using the entire sample are discussed to provide an alternative perspective on the moderating influences of various latent class indicators on later externalizing behaviors.

### *Descriptive Statistics*

Means, standard deviations, and minimum/maximum values of all study variables are presented in Table 1, as well as frequency counts and percentages for relevant variables. Standard scores on all age-normed instruments were in the average range (i.e., language, adaptive communication, and externalizing behavior scores). Based on criteria reported by Qi and Kaiser (2004) to identify language delay among children attending Head Start, I calculated the proportion of children with PLS-4 standard scores at or below 1.3 *SDs* below the mean (i.e.,  $\leq$  standard score of 81). In the current sample, 4.2% of the sample ( $n = 6$ ) had scores suggestive of receptive language delay, 4.9% had scores suggestive of expressive language delay ( $n = 7$ ), and fewer than 1% had scores suggestive of both receptive and expressive language delay ( $n = 1$ ).

According to criteria for typical language scores (i.e.,  $\geq$  standard score of 90; Qi & Kaiser, 2004), 68% of the current sample ( $n = 89$ ) had both expressive and receptive language scores in the typical range. Over 30% of the current sample “at risk” scores

(i.e., standard score of 82–89) in at least 1 language domain ( $n = 44$ ).

In terms of externalizing behavior scores at Time 1, 13 children (9.0%) had scores in at least the elevated range (i.e.,  $T \geq 60$ ); this number increased to 17 children (11.8%) at Time 2. Conversely, over one-fifth of the sample had externalizing behavior scores in the low range (i.e.,  $T < 40$ ) at Time 1 ( $n = 30$ ; 20.8%) and Time 2 ( $n = 32$ ; 22.2%).

Regarding anger/frustration, the current sample's mean score on the CBQ was significantly lower for 3-year-olds ( $M = 3.95$ ,  $SD = .90$ ), compared to the mean score for 3-year-olds reported by the measure's authors ( $M = 4.68$ ,  $SD = .83$ ; Rothbart et al., 2001),  $t(82) = 7.32$ ,  $p = .00$ . Four- to 5-year-olds in the current study ( $M = 4.27$ ,  $SD = .97$ ) had similar anger/frustration scores to those reported by Rothbart et al. ( $M = 4.51$ ,  $SD = .79$ ),  $t(60) = 1.93$ ,  $p = .06$ .

Table 1. *Descriptive Statistics for Study Variables across Whole Sample*

Variable	Mean or Percentage ( $n$ )	Standard deviation	Minimum - Maximum
Receptive language	96.98	11.10	78.00 – 129.00
Anger/frustration	4.09	.95	1.85 – 6.93
Adaptive communication	50.97	8.73	33.00 – 71.00
Expressive language	99.78	13.07	62.00 – 145.00
Time 1 externalizing	48.78	9.18	36.00 – 82.00
Time 2 externalizing	49.08	9.78	36.00 – 92.00
Age	47.42	7.54	36.00 – 61.00
Nonverbal IQ	92.59	12.34	72.00 – 128.00
Household income	22345.81	16594.88	2052.00 – 96000.00

### *Sex differences in study variables*

Independent sample *t*-tests (boys vs. girls) were conducted to evaluate sex differences for each variable, given that some research suggests higher rates of disruptive behavior disorders and early language difficulties among boys (e.g., Horwitz, 2003; Keenan & Shaw, 1997; Webster-Stratton, 1996). Results indicated that boys had marginally higher and lower levels, respectively, of Time 2 externalizing behaviors,  $t(142) = 1.91, p = .06, d = .32$ , and adaptive communication,  $t(142) = 1.73, p = .09, d = .29$ , although this was not significant at the .05 level. Boys and girls had similar levels of anger/frustration,  $t(142) = .69, p = .49, d = .12$ ; receptive language,  $t(142) = 1.13, p = .26, d = .19$ ; expressive language,  $t(142) = .77, p = .44, d = .13$ ; nonverbal cognitive ability,  $t(142) = .67, p = .50, d = .11$ ; Time 1 externalizing behaviors,  $t(142) = 1.61, p = .11, d = .27$ ; age,  $t(142) = .25, p = .80, d = .04$ ; or income,  $t(142) = .07, p = .94, d = .01$ .

Chi-square analyses indicated that there were similar numbers of girls and boys who received speech therapy,  $\chi^2(1) = 2.29, p = .13, w = .13$ .

### *Differences between cohorts and Head Start centers*

Additional independent-samples *t* and one-way ANOVA tests were conducted to determine whether children's levels of study variables differed as a function of their cohort or Head Start center. Children recruited during the 2008-2009 academic year had significantly higher levels of receptive language ( $M = 100.55$ ), compared to children recruited during the 2009-2010 academic year ( $M = 95.14$ ),  $t(142) = 2.84, p = .01, d = .48$ . However, because both scores still fell within the average range, this was not considered a clinically meaningful difference. Children across cohorts had similar levels of Time 1 externalizing behaviors,  $t(142) = .51, p = .61, d = .09$ ; Time 2 externalizing

behaviors,  $t(142) = .30, p = .76, d = .05$ ; child age,  $t(142) = .02, p = .99, d = .00$ ; household income,  $t(142) = .07, p = .95, d = .01$ ; expressive language,  $t(142) = .54, p = .42, d = .09$ ; nonverbal cognitive ability,  $t(142) = 1.42, p = .16, d = .24$ ; anger/frustration,  $t(142) = 1.25, p = .21, d = .21$ ; and adaptive communication,  $t(142) = .79, p = .43, d = .13$ . There were similar proportions of male and female children recruited from each cohort,  $\chi^2(1) = .41, p = .52, w = .05$ ; and marginally higher numbers of children receiving speech therapy services in the 2008-2009 academic year,  $\chi^2(1) = 3.68, p = .06, w = .16$ .

When comparing children across the four Head Start sites, children did not differ in terms of Time 1 externalizing behaviors,  $F(3, 139) = .22, p = .88, \omega^2 = .02$ ; Time 2 externalizing behaviors,  $F(3, 139) = 1.64, p = .18, \omega^2 = .01$ ; child age,  $F(3, 139) = .79, p = .49, \omega^2 = .00$ ; household income,  $F(3, 139) = .30, p = .82, \omega^2 = .01$ ; expressive language,  $F(3, 139) = 1.32, p = .27, \omega^2 = .01$ ; nonverbal cognitive ability,  $F(3, 139) = 1.58, p = .19, \omega^2 = .01$ ; anger/frustration,  $F(3, 139) = 1.89, p = .13, \omega^2 = .02$ ; adaptive communication,  $F(3, 139) = 2.02, p = .11, \omega^2 = .02$ ; or receptive language,  $F(3, 139) = .38, p = .77, \omega^2 = .01$ . In addition, chi-square testing demonstrated that across all centers, there was a similar representation of male and female children,  $\chi^2(3) = 3.36, p = .34, w = .15$ ; and children receiving speech therapy services,  $\chi^2(3) = 3.82, p = .28, w = .16$ .

#### *Bivariate correlations*

Table 2 reports bivariate Pearson correlations among all continuous study variables. There was a significant negative association between adaptive communication and externalizing behaviors at Time 1 and Time 2 ( $r$  values =  $-.38$  and  $-.32$ , respectively,  $ps < .01$ ). In addition, expressive language was negatively associated with externalizing

behaviors at Time 2 ( $r = -.17, p < .05$ ). Household income was positively associated with both expressive language ( $r = .17, p < .05$ ) and adaptive communication ( $r = .18, p < .05$ ). As expected, language variables, adaptive communication, and nonverbal cognitive ability were positively correlated ( $r$  values range from .38 to .72, all  $ps < .01$ ). Contrary to expectations, anger/frustration was not significantly correlated with any other variable.

Table 2. *Bivariate Correlations among Study Variables*

Variable	1	2	3	4	5	6	7	8
1. Receptive language	-							
2. Anger/frustration	-.12	-						
3. Adaptive communication	.49**	-.11	-					
4. Expressive language	.72**	-.09	.47**	-				
5. Time 1 externalizing	-.15	.11	-.38**	-.12	-			
6. Time 2 externalizing	-.14	.12	-.32**	-.17*	.64**	-		
7. Child age	-.24**	.09	-.08	-.26**	-.14	-.12	-	
8. Nonverbal IQ	.47**	-.14	.38**	.45**	-.26**	-.19	.12	-
9. Household income	.12	.03	.17*	.18*	.03	.19*	.01	.13

\*  $p < .05$ . \*\*  $p < .01$ .

*Person-Centered Analyses*

*Latent class analysis*

As described above, a LCA was conducted to identify groups of children based on

child sex, receptive language, adaptive communication, and temperamental anger/frustration. Table 3 shows the statistical fit indices for 1- to 5-class models, which suggested that the best candidate models were the 2-class and 3-class models. In terms of classification quality, the two models were comparable. Class-level posterior probabilities ranged from .84 to .94 for the 2-class model and from .79 to .93 for the 3-class model. At the individual level, the two models contained similar proportions of individuals with posterior probabilities of at least .75 (88% for the 2-class model; 84% for the 3-class model). However, information criteria clearly supported the selection of different models. Specifically, the BIC supported the 2-class model, whereas both the AIC and ABIC were more suggestive of the 3-class model.

Despite being associated with a higher BIC value, the 3-class model ultimately was selected for several reasons. First, examination of the 3-class BLRT  $p$  value indicated that a 3-class solution improved model fit over a 2-class solution at a marginally significant level ( $p = .07$ ). Addition of another class to the 3-class solution did not significantly improve model fit (4-class BLRT  $p = .67$ ). Second, although the 3-class model was associated with a slight increase in the BIC value over the 2-class model, the sample-size adjusted BIC was lower in the 3-class model, compared to the 2-class model. Third, the AIC value began to level off after the 3-class model—suggesting that model fit dramatically improved between the 2-class and 3-class models—even though the 5-class model had the lowest absolute value. Finally, and most importantly, in terms of conceptual interpretation, the third class associated with the 3-class solution was consistent with *a priori* hypotheses, which specified a group with higher levels of adaptive communication relative to receptive language. Thus, statistical and conceptual

considerations supported the selection of the 3-class model.

Table 3. *Class Model Comparison*

Classes	Log likelihood	Free parameters	AIC	BIC	ABIC	BLRT
1	-1323.519	7	2661.04	2681.83	2659.68	-
2	-1299.299	12	2622.59	2658.24	2620.26	0.00
3	-1291.674	17	2617.35	2667.84	2614.04	0.07
4	-1286.848	22	2617.69	2683.03	2613.42	0.67
5	-1280.568	27	2615.14	2695.32	2609.89	0.20

*Note.* AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; ABIC = Sample-size Adjusted Bayesian Information Criterion; BLRT = Bootstrap Likelihood Ratio Test.

*Interpretation of the 3-class model*

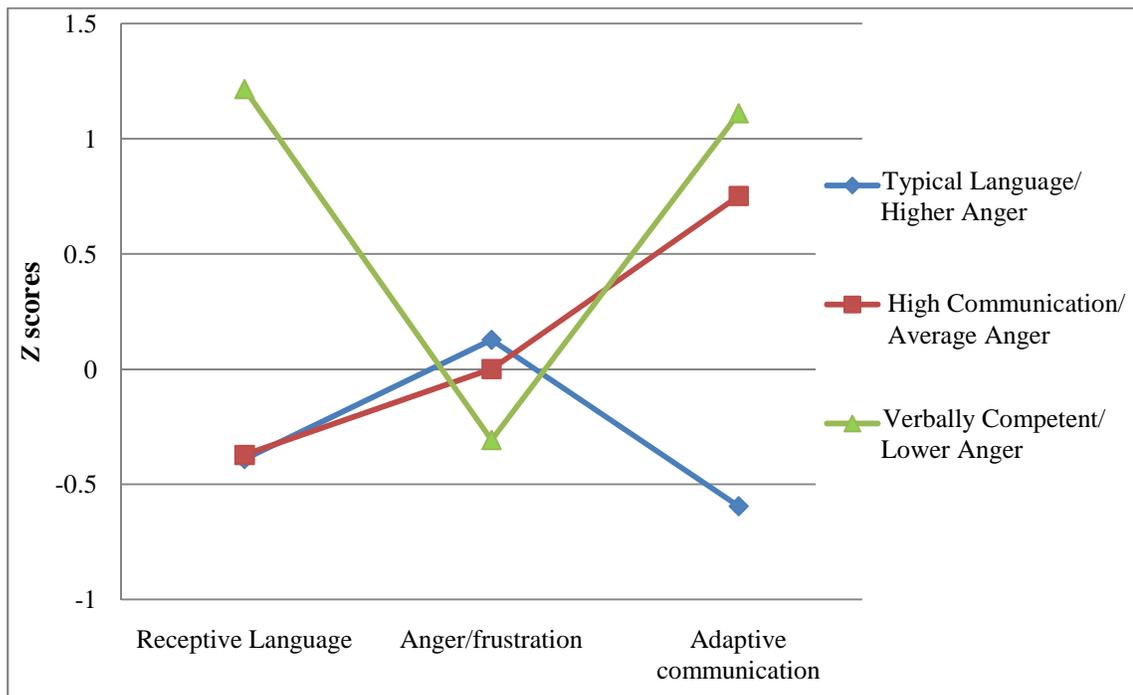
Figure 3 depicts standardized scores of class indicators for all latent classes. Class 1 ( $n = 89$ ; 61.8%) was named the Typical Language/Higher Anger Class. Children in this class had receptive language and adaptive communication standard scores that fell in the Average range and approximately 0.4 to 0.6 standard deviations below the full sample mean. Although children’s levels of anger/frustration were average when compared to the full sample, this class had the highest anger/frustration ratings of the three classes, approximately 0.44 standard deviations above the class with the lowest ratings. Males comprised over 60% of the children in the Typical Language/Higher Anger class and were over 1.5 times more likely to be categorized in this class, relative to female children (OR = 1.58).

Class 2 ( $n = 19$ ; 13.2%), which was labeled High Communication/Average

Anger, contained children with above-average levels of adaptive communication and otherwise average receptive language and anger/frustration scores. Adaptive communication scores were approximately 0.75 standard deviations above the full sample mean and 1.35 standard deviations above the Typical Language/Higher Anger class. Notably, this class consisted entirely of female children.

Class 3 ( $n = 36$ ; 25%), the Verbally Competent/Lower Anger class, was distinguished by having the highest scores on both receptive language and adaptive communication (1.1 to 1.25 *SDs* above the full sample mean). Children in this class also evidenced the lowest ratings of anger/frustration in the sample (0.30 *SDs* below the full sample mean). The Verbally Competent/Lower Anger class contained a fairly even proportion of male and female children (55.6% male).

Figure 3. *Standardized scores on latent class indicators by latent class*



## *Class-Specific Variable-Centered Analyses*

### *Between-class differences*

One-way ANOVA tests were conducted to examine between-class differences in latent class indicators (i.e., receptive language, anger/frustration, and adaptive communication) and covariates (i.e., child age, nonverbal IQ, household income, and externalizing behaviors at Times 1 and 2). In addition, chi-square analyses were conducted to test for non-equivalence across latent classes in terms of child sex and children's receipt of speech therapy. Results are displayed in Table 4.

*Class differences in latent class indicators.* Results indicated significant group differences in receptive language,  $F(2, 140) = 77.52, p < .01, \omega^2 = .52$ ; adaptive communication,  $F(2, 140) = 111.20, p < .01, \omega^2 = .61$ ; and anger/frustration,  $F(2, 140) = 3.40, p < .05, \omega^2 = .04$ . The Tukey HSD test indicated that the Verbally Competent/Lower Anger group had significantly higher levels of receptive language than the other two classes. Both the Verbally Competent/Lower Anger and the High Communication/Average Anger classes significantly outscored the Typical Language/Higher Anger class on adaptive communication. Finally, children in the Typical Language/Higher Anger class had significantly higher ratings of anger/frustration, compared to children in the Verbally Competent/Lower Anger class.

*Class differences in covariates.* Latent classes differed significantly in terms of age,  $F(2, 140) = 4.77, p < .05, \omega^2 = .05$ ; expressive language,  $F(2, 140) = 41.03, p < .01, \omega^2 = .36$ ; nonverbal cognitive ability scores,  $F(2, 140) = 12.84, p < .01, \omega^2 = .14$ ; Time 1 externalizing behaviors,  $F(2, 140) = 8.53, p < .01, \omega^2 = .10$ ; and Time 2 externalizing

behaviors,  $F(2, 140) = 4.09, p < .05, \omega^2 = .04$ . Post-hoc testing indicated that, compared to both of the other classes, the Verbally Competent/Lower Anger class was younger and had higher levels of expressive language. The Verbally Competent/Lower Anger class also obtained higher nonverbal cognitive ability scores, compared to the Typical Language/Higher Anger class. The Typical Language/Higher Anger class was rated as exhibiting higher levels of externalizing behaviors compared to (a) the Verbally Competent/Lower Anger class at Time 2, and (b) both of the other classes at Time 1. Classes did not differ in terms of reported household income,  $F(2, 140) = .51, p = .60, \omega^2 = .00$ .

*Class differences in proportions of child sex and receipt of speech therapy.* Chi-square analyses indicated that the child sex distribution varied significantly across classes,  $\chi^2(2) = 23.41, p < .01, w = .40$ . Examination of observed class counts and follow-up pairwise analyses revealed that child sex proportions were similar between the Typical Language/Higher Anger and Verbally Competent/Lower Anger classes ( $p = .59$ ). However, compared to each of these classes, the High Communication/Average Anger class had far fewer male children than expected (both  $p$  values  $< .01$ ).

The proportion of children receiving speech therapy at school did not differ significantly across groups,  $\chi^2(2) = 3.91, p = .14, w = .16$ .

Table 4. *Study Variable Means and Proportions by Latent Class*

Variable	Class 1: Typical Language/ Higher Anger	Class 2: High Communication/ Average Anger	Class 3: Verbally Competent/ Lower Anger	Total Sample Mean (SD)
Receptive language	92.52 <sup>a</sup>	91.58 <sup>a</sup>	110.86 <sup>b</sup>	96.98 (11.10)
Anger/frustration	4.25 <sup>a</sup>	3.97	3.75 <sup>b</sup>	4.09 (.95)
Adaptive communication	45.69 <sup>a</sup>	57.43 <sup>b</sup>	60.56 <sup>b</sup>	50.97 (8.73)
Expressive language	94.85 <sup>a</sup>	97.00 <sup>a</sup>	113.44 <sup>b</sup>	99.78 (13.07)
Time 1 externalizing	51.15 <sup>a</sup>	45.53 <sup>b</sup>	44.66 <sup>b</sup>	48.78 (9.18)
Nonverbal IQ	89.18 <sup>a</sup>	93.32	100.64 <sup>b</sup>	92.59 (12.34)
Household income	21236	24024	24199	22345 (16595)
Proportion of males	60.67% <sup>a</sup>	0.00% <sup>b</sup>	55.55% <sup>a</sup>	51.39%
Proportion receiving speech therapy	19.10%	5.26%	8.33%	14.58%

<sup>a b</sup> Values with different superscripts are significantly different at  $p < .05$ .

*Differential relations between expressive language and externalizing relations by latent class*

Hierarchical regression analyses were conducted separately for each class. Power analyses suggested limited power to detect a small-to-medium effect (16% to 27%).

Thus, as noted above, due to power considerations and relatively small and unequal class sizes, a non-parametric bootstrapping procedure also was conducted using 1000 resamples to obtain confidence intervals for the regression slopes.

*Regression analysis results.* Results indicated that—after controlling for child

age, Time 1 externalizing symptoms, household income, nonverbal cognitive ability, and receipt of speech therapy—expressive language was negatively associated with Time 2 externalizing behaviors across classes ( $\beta$  values =  $-.11$  to  $-.35$ ; Table 5). Although small cell sizes and low power precluded confirmation that the class-specific regression slopes differed significantly from zero ( $p$  values =  $.18$  to  $.26$ ), the effect sizes and beta weights for each class suggested that the magnitude of the relations between expressive language ability and Time 2 externalizing behaviors appears to differ by latent class.

After expressive language was added to the regression equation, there were some notable class differences in the change in the  $R^2$  statistic and related effect sizes. Expressive language explained an additional 10% of the variance in Time 2 externalizing behaviors among children in the High Communication/Average Anger class ( $f^2 = .11$ ), whereas expressive language explained only an additional 1% of the variance among children in the Typical Language/Higher Anger class ( $f^2 = .01$ ) and an additional 3% of the variance among children in the Verbally Competent/Lower Anger class ( $f^2 = .03$ ).

In terms of standardized beta weights, the High Communication/Average Anger class was associated with the beta weight of the greatest magnitude ( $\beta = -.35$ ), compared to the Typical Language/Higher Anger class ( $\beta = -.11$ ) and the Verbally Competent/Lower Anger class ( $\beta = -.22$ ). Notably, within the High Communication/Average Anger class, the magnitude of the beta weight for expressive language approached the beta weight for Time 1 externalizing behaviors ( $\beta = .39$  in Steps 1 and 2), suggesting that the predictive power of expressive language for children in this class may be comparable to that of past externalizing behaviors. Other predictors that attained statistical significance in Step 2 included Time 1 externalizing behaviors for the

Typical Language/Higher Anger ( $\beta = .72, p < .01$ ) and Verbally Competent/Lower Anger ( $\beta = .42, p < .05$ ) classes, as well as household income for these two classes ( $\beta s = .19$  and  $.49$ , both  $ps < .05$ ).

Table 5. *Latent Class-Specific Hierarchical Regression Analysis Summary for Expressive Language in Predicting Time 2 Externalizing Behaviors*

Step and Variable	Latent Class Name	<i>B</i>	<i>SE B</i>	$\beta$	$R^2$	$\Delta R^2$	$f^2$
<b>Step 1</b>							
Step 1 Covariates and Model Statistics	Typical Language/Higher Anger				.56	.56**	1.27
	High Communication/Average Anger				.19	.19	.23
	Verbally Competent/Lower Anger				.29	.29	.41
Time 1 Externalizing	Typical Language/Higher Anger	.76	.03	.72**			
	High Communication/Average Anger	.46	.10	.39			
	Verbally Competent/Lower Anger	.46	.06	.37*			
Child age	Typical Language/Higher Anger	-.05	.03	-.04			
	High Communication/Average Anger	-.11	.09	-.11			
	Verbally Competent/Lower Anger	-.03	.07	-.02			
Nonverbal IQ	Typical Language/Higher Anger	.04	.02	.05			
	High Communication/Average Anger	.46	.10	.09			
	Verbally Competent/Lower Anger	-.15	.04	-.21			

Table 5. (continued)

Step and Variable	Latent Class Name	<i>B</i>	<i>SE B</i>	$\beta$	$R^2$	$\Delta R^2$	$f^2$
Household income	Typical Language/Higher Anger	.00	.00	.18*			
	High Communication/Average Anger	.00	.00	.06			
	Verbally Competent/Lower Anger	.00	.00	.42*			
Speech therapy (1=yes, 0=no)	Typical Language/Higher Anger	-3.30	.58	-.13			
	High Communication/Average Anger	5.86	2.77	.15			
	Verbally Competent/Lower Anger	-8.31	1.69	-.27			
<b>Step 2</b>							
Step 2 Model Statistics	Typical Language/Higher Anger				.57	.01	.01
	High Communication/Average Anger				.29	.10	.11
	Verbally Competent/Lower Anger				.32	.03	.03
Expressive language	Typical Language/Higher Anger	-.10	.02	-.11			
	High Communication/Average Anger	-.37	.07	-.35			
	Verbally Competent/Lower Anger	-.17	.04	-.22			

\*  $p < .05$ . \*\*  $p < .01$ .

*Bootstrap results.* The bootstrap 95% confidence intervals were examined separately for each latent class (Table 6). None of the latent classes' confidence intervals contained zero, indicating that the expressive language regression slopes differed significantly from zero at the .05 level across classes. Thus, the negative relation between

expressive language and Time 2 externalizing behaviors was upheld for all classes. However, the magnitude of this negative relation differed significantly by class, as evidenced by the lack of overlap between the bootstrap confidence intervals of the High Communication/Average Anger class (-.54 to -.19) and the Typical Language/Higher Anger class (-.15 to -.05). Specifically, the confidence interval associated with the High Communication/Average Anger class indicated an effect of greater magnitude. The confidence interval associated with the Verbally Competent/Lower Anger class (-.26 to -.09) overlapped with the confidence intervals of both of the other classes, indicating no significant difference in the strength of the expressive language-externalizing behavior relation.

Table 6. *Latent-Class Specific Bootstrap Analysis Summary for Expressive Language in Predicting Time 2 Externalizing Behaviors (1000 Bootstrap Resamples)*

Step and Variable	Latent Class Name	<i>B</i>	<i>SE B</i>	Bootstrap 95% Confidence Interval for <i>B</i>	
				Lower	Upper
<b>Step 1</b>					
Time 1 Externalizing	Typical Language/Higher Anger	.76	.03	.71	.81
	High Communication/Average Anger	.46	.10	.29	.61
	Verbally Competent/Lower Anger	.46	.06	.38	.55
Child age	Typical Language/Higher Anger	-.05	.03	-.12	.03
	High Communication/Average Anger	-.11	.09	-.30	.07
	Verbally Competent/Lower Anger	-.03	.07	-.13	.07

Table 6. (continued)

Step and Variable	Latent Class Name	<i>B</i>	<i>SE B</i>	Bootstrap 95% Confidence Interval for <i>B</i>	
				Lower	Upper
Nonverbal IQ	Typical Language/Higher Anger	.04	.02	.01	.08
	High Communication/Average Anger	.46	.10	-.16	.01
	Verbally Competent/Lower Anger	-.15	.04	-.21	-.09
Speech therapy (1=yes, 0=no)	Typical Language/Higher Anger	-3.30	.58	-4.29	-2.34
	High Communication/Average Anger	5.86	2.77	3.62	7.89
	Verbally Competent/Lower Anger	-8.31	1.69	-11.92	-5.66
<b>Step 2</b>					
Expressive language	Typical Language/Higher Anger	-.10	.02	-.15	-.05
	High Communication/Average Anger	-.37	.07	-.54	-.19
	Verbally Competent/Lower Anger	-.17	.04	-.26	-.09

*Post-Hoc Whole-Sample Variable-Centered Analyses*

*Prospective relations between expressive language and Time 2 externalizing behaviors*

OLS hierarchical regression analyses indicated that, after controlling for child sex, age, Time 1 externalizing behaviors, household income, nonverbal cognitive ability, receptive language, anger/frustration, adaptive communication, and receipt of speech therapy, there was a significant negative relation between expressive language and Time 2 externalizing behaviors ( $\beta = -.19$ ,  $t(133) = -2.03$ ,  $p < .05$ ). Table 7 includes regression

weights associated with each step; when all variables were considered concurrently in Step 2, other significant predictors were Time 1 externalizing behaviors ( $\beta = .58, p < .01$ ), household income ( $\beta = .22, p < .01$ ), and receipt of speech therapy ( $\beta = -.15, p < .05$ ).

Table 7. *Regression Analysis Summary for Expressive Language in Predicting Time 2 Externalizing Behaviors (N = 144)*

Step and Variable	B	SE B	$\beta$	95% CI for B		$R^2$	$\Delta R^2$	$f^2$
				Lower	Upper			
Step 1						.48	.48**	.92
Time 1 externalizing	.61	.07	.57**	.46	.75			
Child sex (1 = male, 0 = female)	1.58	1.26	.08	-.91	4.07			
Child age	-.11	.09	-.08	-.283	.06			
Receptive language	-.04	.07	-.05	-.19	.10			
Anger/frustration	.67	.67	.07	-.65	1.99			
Adaptive communication	-.15	.09	-.14	-.33	.03			
Nonverbal IQ	.02	.05	.03	-.09	.13			
Household income	.00	.00	.20**	.00	.00			
Receipt of speech therapy (1=yes, 0=no)	-3.58	1.79	-.13*	-7.13	-.03			
Step 2						.50	.02*	.02
Expressive language	-.14	.07	-.19*	-.29	-.00			

Note.  $f^2$  = effect size.

\*  $p < .05$ . \*\*  $p < .01$ .

*Concurrent relations between expressive language and Time 1 externalizing behaviors*

OLS hierarchical regression analyses indicated that, after controlling for covariates, there was not a significant relation between expressive language and Time 1 externalizing behaviors ( $\beta = .08$ ,  $t(134) = .69$ ,  $p = .49$ ). Table 8 includes regression weights associated with each step; when all variables were considered concurrently in Step 2, the only significant predictor was adaptive communication ( $\beta = -.37$ ,  $p < .05$ ).

Table 8. *Regression Analysis Summary for Associations between Expressive Language and Time 1 externalizing behaviors (N = 144)*

Step and Variable	B	SE B	$\beta$	95% CI for B		$R^2$	$\Delta R^2$	$f^2$
				Lower	Upper			
Step 1						.20	.20**	.25
Child sex (1 = male, 0 = female)	1.07	1.46	.06	-1.82	3.96			
Child age	-.17	.09	-.14	-.37	.02			
Receptive language	.05	.08	.06	-.11	.22			
Anger/frustration	.48	.78	.05	-1.07	2.03			
Adaptive communication	-.39	.09	-.37**	-.58	-.19			
Nonverbal IQ	-.12	.07	-.16	-.25	.02			
Household income	.00	.00	.01	.00	.00			
Receipt of speech therapy (1=yes, 0=no)	-.33	2.08	-.01	-4.44	3.79			

Table 8. (continued)

Step and Variable	<i>B</i>	<i>SE B</i>	$\beta$	95% CI for <i>B</i>		<i>R</i> <sup>2</sup>	$\Delta R^2$	<i>f</i> <sup>2</sup>
				Lower	Upper			
Step 2						.20	.00	.00
Expressive language	.06	.09	.08	-.11	.23			

Note. *f*<sup>2</sup> = effect size.

\* *p* < .05. \*\* *p* < .01.

*The interaction of expressive language and selected latent class indicators in predicting Time 2 externalizing behaviors*

*Expressive language, anger/frustration, and adaptive communication.* To examine the interactive effect of expressive language and latent class indicators using a variable-centered analytic framework, a three-way interaction between expressive language, anger/frustration, and adaptive communication was examined. A hierarchical regression analysis was conducted with Time 2 externalizing behaviors as the dependent variable. Age, Time 1 externalizing behaviors, child sex, household income, receptive language, and nonverbal cognitive ability were entered in the first step. In the second step, the anger/frustration, expressive language, and adaptive communication variables were entered. All three possible two-way cross-product interaction terms were entered in the third step, and the three-way expressive language × anger/frustration × adaptive communication cross-product interaction term was entered in the fourth step.

After controlling for covariates in Step 1, the conditional expressive language, anger/frustration, and adaptive communication variables in Step 2, and all two-way interaction terms in Step 3, regression analyses indicated that the expressive language ×

anger/frustration  $\times$  adaptive communication interaction term negatively predicted Time 2 externalizing behaviors ( $\beta = -.16$ ,  $t(129) = 1.96$ ,  $p = .05$ ). Table 9 includes regression weights associated with each step; when all variables were considered concurrently in Step 4, significant predictors included Time 1 externalizing behaviors ( $\beta = .55$ ,  $p = .00$ ), household income ( $\beta = .20$ ,  $p = .00$ ), receipt of speech therapy ( $\beta = -.15$ ,  $p = .02$ ), and the expressive language  $\times$  anger/frustration interaction term ( $\beta = .18$ ,  $p = .03$ ).

Table 9. *Regression Analysis Summary for the Interaction of Expressive Language, Anger/Frustration, and Adaptive Communication in Predicting Time 2 Externalizing Behaviors (N = 144)*

Step and Variable	<i>B</i>	<i>SE B</i>	$\beta$	Bootstrap 95% Confidence Interval for <i>B</i>		$R^2$	$\Delta R^2$	$f^2$
				Lower	Upper			
Step 1						.47	.47**	.89
Time 1 externalizing	.65	.07	.61**	.61	.69			
Child sex (1 = male, 0 = female)	1.93	1.25	.10	1.15	2.63			
Child age	-.09	.09	-.07	-.15	-.03			
Receptive language	-.09	.07	-.10	-.13	-.05			
Nonverbal IQ	.01	.05	.01	-.02	.03			
Household income	.00	.00	.19*	.00	.00			
Receipt of speech therapy (1=yes, 0=no)	-2.74	1.75	-.10	-3.59	-1.88			

Table 9. (continued)

Step and Variable	<i>B</i>	<i>SE B</i>	$\beta$	Bootstrap 95% Confidence Interval for <i>B</i>		<i>R</i> <sup>2</sup>	$\Delta R^2$	<i>f</i> <sup>2</sup>
				Lower	Upper			
Step 2						.50	.03*	.03
Expressive language	-.14	.07	-.19*	-.19	-.01			
Anger/frustration	.74	.66	.07	.26	1.22			
Adaptive Communication	-.13	.09	-.12	-.18	-.08			
Step 3						.51	.01	.01
Expressive language × anger/frustration	.08	.05	.11	.04	.11			
Expressive language × adaptive communication	.00	.01	.02	-.00	.01			
Adaptive communication × anger/frustration	-.03	.09	-.02	-.08	.03			
Step 4						.52	.01*	.01
Expressive language × anger/frustration × adaptive communication	-.01	.01	-.16*	-.01	-.00			

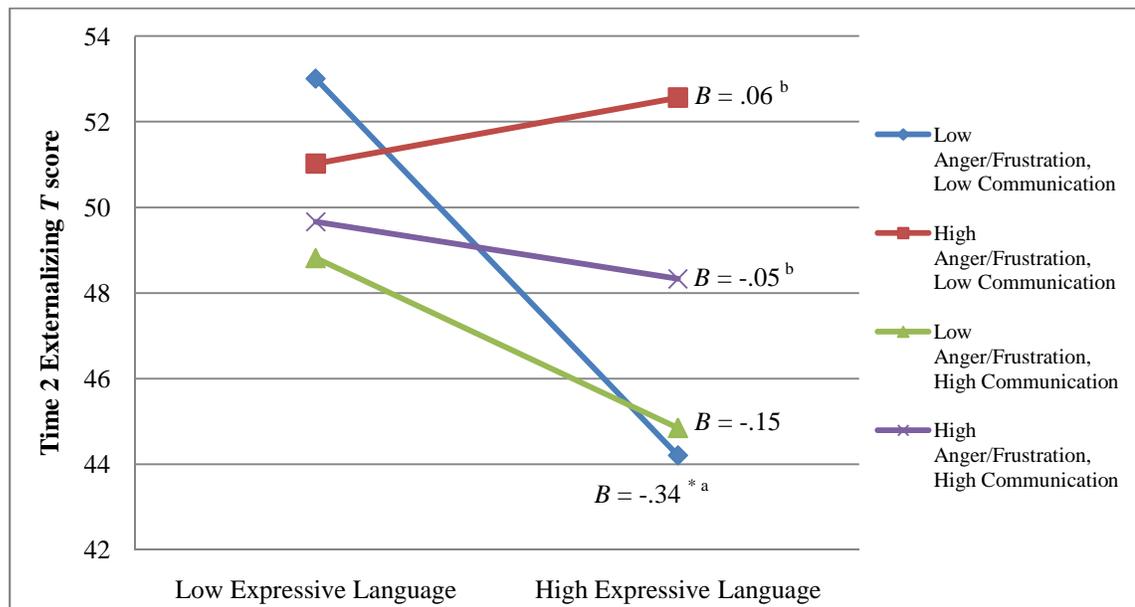
Note.  $f^2$  = effect size.

\*  $p \leq .05$ . \*\*  $p < .01$ .

Post-hoc probing (Preacher et al., 2006) revealed that the slope associated with children experiencing low anger/low adaptive communication was significantly different from zero ( $B = -.34$ ,  $t(129) = 2.99$ ,  $p = .00$ ; see Figure 4). Thus, among children with low

anger and low adaptive communication, levels of Time 2 externalizing behaviors were significantly lower in the context of high levels of expressive language, compared to low levels of expressive language. Regression slopes were not significantly different from zero among children with low anger/high adaptive communication ( $B = -.15$ ,  $t(129) = 1.53$ ,  $p = .13$ ,  $d = .27$ ), high anger/high adaptive communication ( $B = -.05$ ,  $t(129) = .55$ ,  $p = .58$ ,  $d = .10$ ), or high anger/low adaptive communication ( $B = .06$ ,  $t(129) = .46$ ,  $p = .65$ ,  $d = .08$ ).

Figure 4. *Relation between expressive language and Time 2 externalizing T scores among children with high (1 SD above the mean) vs. low (1 SD below the mean) levels of anger/frustration and adaptive communication.*



\* Indicates regression slope is significantly different from zero.

<sup>a, b</sup> Different superscripts indicate that regression slopes are significantly different from each other.

Slope difference testing (Dawson & Richter, 2006) indicated that the slope associated with the combination of low anger/frustration and low adaptive

communication was significantly different from the slopes associated with both high anger/frustration and low adaptive communication,  $t(129) = 2.41, p = .02, d = .42$ ; and high anger/frustration and high adaptive communication  $t(129) = 2.02, p = .04, d = .36$ .

*Expressive language, anger/frustration, and child sex.* A second hierarchical regression analysis was conducted with Time 2 externalizing behaviors as the dependent variable. Age, Time 1 externalizing behaviors, household income, receptive language, and nonverbal cognitive ability were entered in the first step. After controlling for these covariates in Step 1, the conditional expressive language, anger/frustration, and dummy-coded child sex variables in Step 2, and all two-way interaction terms in Step 3, the expressive language  $\times$  anger/frustration  $\times$  child sex interaction term did not significantly predict Time 2 externalizing behaviors ( $\beta = -.06, t(129) = -.63, p = .53$ ).

*Expressive language, adaptive communication, and child sex.* A final hierarchical regression analysis was conducted to test the interactive effect of expressive language, adaptive communication, and child sex on Time 2 externalizing behaviors. The expressive language  $\times$  adaptive communication  $\times$  child sex interaction term did not significantly predict Time 2 externalizing behaviors ( $\beta = .22, t(129) = 1.72, p = .09$ ), after accounting for covariates (i.e., age, Time 1 externalizing behaviors, household income, receptive language, nonverbal cognitive ability, and anger/frustration), conditional variables, and two-way interactions in previous steps.

## CHAPTER 4 DISCUSSION

Despite widely documented evidence indicating a negative association between general language ability and behavior problems among young children (Beitchman et al., 1989; Horwitz et al., 2003; McCabe, 2005; Tervo et al., 2007), as well as expressive language more specifically and behavior problems (Hooper et al., 2003; Ripley & Yuill, 2005), the relation between expressive language and behavior problems remains poorly understood. Methodological limitations in the literature to date indicated a need for a conceptually driven, prospective study of typically developing preschool-aged children to examine the effects of expressive language on later behavior problems in the context of multiple moderating influences (Carpenter & Drabick, 2010). Thus, the present study had two main goals: (a) to identify classes of children based on several such moderating influences (i.e., child sex, receptive language, adaptive communication, and anger/frustration), and (b) to determine whether a predictive relation between expressive language and later externalizing behaviors varied by class. Using the entire sample of children, post-hoc analyses also evaluated the general effect of expressive language on later behavior, as well as moderating effects on the expressive language-externalizing behavior relation in a variable-centered framework.

In the following sections, I review the study's three primary sets of findings: (a) the characteristics of the three latent classes, (b) latent class-specific relations between expressive language and externalizing behaviors, and (c) whole-sample relations between expressive language and behavior. These results extend the literature in several important ways. First, findings directly address the moderating influences that govern the predictive

relation between expressive language and later behavior problems by using both person- and variable-centered analyses. Second, findings carry implications for the inclusion of several moderators (i.e., anger/frustration, adaptive communication, and child sex) in future conceptual models. Third, the study addressed gaps in the literature that have precluded conclusions about the role of expressive language variables in the prospective prediction of externalizing symptoms. Finally, findings from this low-income community sample of preschoolers suggest intervention considerations for behavior problems that may be applicable to clinical populations of young children.

#### *Characteristics of Latent Classes*

Person-centered analyses identified three meaningful, qualitatively distinct classes of children based on child sex and levels of receptive language, temperamental anger/frustration, and adaptive communication. The Typical Language/Higher Anger class (61.8%) and the Verbally Competent/Lower Anger class (25.0%) each contained both male and female children but were differentiated by opposite patterns of receptive language ability, adaptive communication, and anger/frustration. The High Communication/Average Anger class (13.2%) contained only female children with high adaptive communication ability, average anger/frustration, and average receptive language ability.

Although a four-class solution was originally hypothesized, the resulting three classes were quite similar to *a priori* hypotheses, which included (a) a generally competent class (similar to the Verbally Competent/Lower Anger class), (b) a generally impaired class (not found), (c) a class with higher communication skills but average receptive language and lower anger/frustration (similar to the High

Communication/Average Anger class), and (d) a class with average receptive language, lower communication, and higher anger/frustration (similar to the Typical Language/Higher Anger class). It was somewhat surprising that results did not identify a class of children with multiple impairments, given that children attending Head Start have been reported to have higher-than-expected rates of language delays and associated difficulties (Qi & Kaiser, 2003, 2004). In the current study, the relatively lower mean levels of receptive language and/or adaptive communication ability identified in some classes were still in the average range compared to the testing instruments' standardization sample. It may be that the study's inclusion/exclusion criteria (e.g., careful screening to rule out global developmental delays) resulted in excluding children with more significant impairments from the sample.

The Typical Language/Higher Anger and Verbally Competent/Lower Anger classes represent the least and most adaptive profiles of functioning in the sample, respectively. Compared to each other, children in these classes significantly differed in terms of their levels of multiple variables, namely, externalizing scores at both time points, nonverbal IQ, anger/frustration, adaptive communication, and both receptive and expressive language. A more nuanced profile emerged in the High Communication/Average Anger class. This class is of particular interest because it suggests that communicative strengths can, and do, exist independently of "pure" language ability. Children in the High Communication/Average Anger class had similar levels of receptive and expressive language ability compared to the Typical Language/Higher Anger class, yet their adaptive communication levels were equivalent to the Verbally Competent/Lower Anger group. The specificity of this pattern to female

children is noteworthy, suggesting that male children attending Head Start may not be likely to exhibit such discrepant language and communication skills.

Efforts in the language-behavior literature to apply person-centered analytic techniques have focused predominantly on identifying language delay typologies (Beitchman et al., 1989; McCabe, 2005), as opposed to combining indices of linguistic functioning with indices of functioning in other domains. For example, in a sample of preschoolers diagnosed with specific language impairment, McCabe (2005) identified subgroups of children based on receptive, expressive, pragmatic, and articulation impairments. Higher levels of behavior problems and lower levels of frustration tolerance were reported among a subgroup of children characterized by broad language/communicative impairments. Although McCabe's result was obtained from a clinical sample, it is consistent with the current finding that the class with lower levels of linguistic/communicative competence (i.e., Typical Language/Higher Anger class) also had the highest levels of anger/frustration.

The conceptual model underlying the person-centered approach used in the current study was influenced by work demonstrating interrelations among young children's language skill, temperament, communication, and emotional lability (e.g., Bowman et al., 2006; Mendez et al., 2002; Noel et al., 2008; Roulstone et al., 2003), as well as an integrative theory of the development of co-occurring language and behavioral difficulties in early childhood (Carpenter & Drabick, 2010). Thus, the conceptual decision to include non-language variables in the latent class analysis is consistent with findings that these variables can exert a proximal effect on language skill and usage. The empirical derivation of three distinct and substantively meaningful classes of preschool-

aged children, based on this multi-domain approach, suggests that future person-centered work in the language-behavior field should consider moving beyond the identification of language-only profiles to incorporate other conceptually relevant variables.

One of the class indicators used in the current study's LCA was child sex, which is less commonly treated as a direct indicator of latent class membership and more often included in analyses as a covariate. However, the specificity of one pattern of child attributes (i.e., high adaptive communication relative to receptive language ability) to female children suggests that child sex may be better treated as a more proximal variable in future research, particularly during the preschool period. Further support for the latent classes identified using this multi-domain, person-centered approach comes from the examination of class-specific expressive language-behavior relations, described next.

*Latent Class-Specific Relations between Expressive Language and  
Later Externalizing Behaviors*

The second goal of the current study was to determine class differences in the prospective relation between expressive language and Time 2 externalizing behaviors. There was little prior literature on young children to guide the development of hypotheses. However, according to the study's conceptual model, only children in the least competent group (with the highest level of anger/frustration and the lowest level of linguistic/communicative ability) were expected to evidence lower levels of externalizing behaviors at Time 2 in the context of higher levels of expressive language. Classes with other competencies (i.e., low anger/frustration, higher receptive language and adaptive communication) were expected to be buffered from the development of later externalizing behaviors, regardless of expressive language ability. This line of reasoning

was consistent with recent research conducted with school-aged children, which indicated that children with higher levels of anger/frustration evidenced a prospective decrease in oppositional defiant symptomatology in the context of higher, as opposed to lower, levels of expressive vocabulary (Carpenter, Steinberg, & Drabick, 2011).

Class-specific variable-centered analyses demonstrated that expressive language negatively predicted externalizing behaviors for all three classes. However, the magnitude of the negative relation between expressive language and later externalizing behaviors appeared to be stronger among children in the High Communication/Average Anger class, relative to the Typical Language/Higher Anger class. For the Verbally Competent/Lower Anger class, the strength of the expressive language-behavior relation was moderate and did not differ from the other two classes. Thus, the study hypothesis was not supported; rather than demonstrating the strongest negative relation between expressive language and Time 2 externalizing behaviors, the Typical Language/Higher Anger class demonstrated the weakest, albeit statistically significant, negative relation.

This pattern of findings suggests that in the preschool developmental period, children may require a certain level of competence in other domains before they can benefit behaviorally from higher levels of expressive language. Developmentally, researchers have pointed to a fundamental relation between self-regulation and language (Luria, 1961; Vygotsky, 1962), with recent conceptual models suggesting a bidirectional relation between these constructs (Nigg, Hinshaw, & Huang-Pollock, 2006). During the preschool period, when effortful control processes are continuing to develop (Diamond & Taylor, 1996), other attributes may need to be in place for children to use and benefit from expressive language skill. For example, possessing lower levels of temperamental

anger/frustration may increase the likelihood that children will be sufficiently self-regulated to use expressive language during conflicts or other challenging events. Also, higher levels of adaptive communication may increase the likelihood that preschoolers will respond verbally (and thus more adaptively) to challenging events. The importance of communicative competence is supported by the significant difference in adaptive communication between the High Communication/Average Anger class (strongest negative relation between expressive language and behavior) and the Typical Language/Higher Anger class (weakest negative relation). It is possible that the High Communication/Average Anger class possessed both sufficient competencies (e.g., higher adaptive communication) to permit the mobilization of expressive language skill and sufficient weaknesses (e.g., relatively low receptive language) to allow for decreases in externalizing behaviors.

Results of these class-specific analyses provide some insight into the type of child for whom expressive language skill is likely to translate into more regulated classroom behavior. Because the three classes were identified empirically based on variation in children's attributes—as opposed to being constructed based on *a priori* expectations—these findings may be more directly applicable to clinical decision-making in preschool settings. Although this was not an intervention study, class-specific associations between expressive and subsequent behavior suggest that not all children would profit equally from a language-based intervention to address externalizing concerns. As a group, female children with communicative strengths, intact comprehension, and average levels of anger/frustration may be good candidates for a language-based intervention. Such an approach may not be the optimal sole or first-line intervention approach for children who

are more easily angered or frustrated and/or have average to weaker communication and comprehension abilities.

However, one drawback to examining class-specific differences in relations between expressive language and externalizing behaviors is that one cannot statistically determine which specific class attributes drive the class differences. For example, the Typical Language/Higher Anger and High Communication/Average Anger classes differed significantly on more than one variable (i.e., child sex, communication). Therefore, post-hoc analyses using the whole sample were conducted to determine how specific combinations of child attributes were associated with Time 2 externalizing behaviors, as well as to determine the relation between expressive language and later externalizing behaviors across the entire sample.

*Whole-Sample Relations between Expressive Language and Externalizing Behaviors*

Across the entire sample of children—controlling for the contributions of other covariates, including receptive language, nonverbal IQ, household income, and other latent class indicators—there was a significant, negative prospective relation between expressive language and Time 2 externalizing behaviors. However, expressive language and externalizing behaviors were not related concurrently at Time 1. These results suggest that the effect of expressive language on later behavior problems may compound over time. Specifically, as the academic and social demands placed on preschool-aged children increase over the course of an academic year, variability in expressive language skill may become more salient in shaping children’s behavioral functioning. A similar pattern was described by Hooper et al. (2003), who found that kindergarteners’ expressive language was increasingly related to conduct problems in subsequent

academic years, although this prospective relation ultimately was not statistically significant in third grade. Thus, the current study extends this work by Hooper et al. and argues for the importance of prospective research designs in future work. Indeed, if expressive language exerts a cumulative effect on children's externalizing behaviors over time, cross-sectional research designs are less likely to be useful for detecting these effects.

To my knowledge, this study is the first to demonstrate a significant negative relation between expressive language and later externalizing behaviors. However, it is consistent with prior research demonstrating that children's communicative competence (e.g., mean length of utterance and conversational turn) prospectively predicted end-of-year behavior problems among preschoolers attending Head Start (Fagan & Iglesias, 2000). The current study's finding contradicts results from other studies that have reported prediction from receptive or globally delayed language ability to behavior problems (Beitchman et al., 1989; Estrem, 2005; Menting et al., 2011; McCabe, 2005; van Daal et al., 2007), as well as studies that reported no association between expressive language and externalizing behavior (McCabe, 2005; Ross & Weinberg, 2006). Such prior null findings may be attributable to other studies' examination of only concurrent expressive language-behavior relations, as discussed above, and/or insufficient inclusion of relevant covariates in conceptual and statistical models. The current study specifically sought to address such methodological limitations by using a prospective design and by attempting to rule out the contributions of other relevant child characteristics and variables. Controlling for covariates permitted greater confidence about the specific effect of expressive language on subsequent externalizing behaviors because the effects

of nonverbal cognitive ability (Gilliam & deMesquita, 2000) and receptive language ability (e.g., Ross & Weinberg, 2006) were taken into account.

Inconsistencies between the current study and prior work also may reflect sample differences. To limit the possibility that broader neurodevelopmental immaturity might account for both language and behavior problems (e.g., Pine et al., 1997), the current study's enrollment was restricted to children without global developmental delays or intellectual/developmental disability. It is quite possible that different processes underlie the co-occurrence of expressive language and later behavior problems among children with typical vs. atypical development. The present focus on a low-income, community sample helped to illuminate heterogeneity in expressive language-behavior relations among typically developing children. However, among children with cognitive, developmental, and/or severe linguistic impairments—who have been represented in other studies (e.g., McCabe, 2005)—there may be less variability in expressive language; alternatively, expressive language's potential predictive utility as a risk or protective factor may be overshadowed by these more pervasive impairments. Thus, the finding of a negative prospective relation between expressive language and behavior problems does not hold true among all preschool-aged children. This study's contribution to the broader literature lies in its results regarding the circumstances under which this relation holds true, namely, among lower income preschool-aged children who exhibit different profiles of co-occurring attributes.

Therefore, to elucidate further the moderating influences on the relation between expressive language and Time 2 externalizing behaviors, various combinations of latent class indicators were tested in moderational analyses. Three-way interaction analyses

indicated that expressive language's effect on later externalizing behaviors depends on co-occurring combinations of anger/frustration and adaptive communication.

Specifically, among children with low levels of adaptive communication, only children with lower levels of anger/frustration evidenced a significant decrease in externalizing behaviors in the context of high expressive language. Among children with low anger/frustration, both high and low levels of adaptive communication were associated with similar levels of behavior problems when these children also exhibited higher levels of expressive language. This suggests that possessing low anger/frustration is integral to children's ability to benefit behaviorally from higher levels of expressive language.

Children with calm temperamental styles may be better able to apply expressive language skills in challenging situations before, or as opposed to, resorting to physical and/or disruptive responses. Also, this finding suggests that the behavior problems exhibited by children with low anger/frustration may be partly a function of poor language/communicative skills. Thus, expressive language skill-building may be a useful intervention target among children with low levels of anger/frustration, regardless of their adaptive communication abilities.

Children with high levels of anger/frustration did not differ in their levels of externalizing behaviors at low or high expressive language levels, regardless of adaptive communication. Compared to children with high anger/frustration and low adaptive communication—whose externalizing behaviors *increased* at high levels of expressive language—children with both high anger/frustration and high adaptive communication evidenced a relative *decrease* in externalizing behaviors in the context of high expressive language (although this was not significantly different from zero). Thus, in the context of

both high anger/frustration and high expressive language, high adaptive communication appears to confer a modest benefit (approximately 4 *T*-score points lower on externalizing behaviors). However, high levels of adaptive communication did not significantly offset risk for higher externalizing behaviors among children with high anger/frustration and high expressive language.

#### *Class-specific Differences Versus Variable-Centered Moderational Results*

Person- and variable-centered results provide different lenses through which to view the data, with different advantages and disadvantages. Person-centered approaches provide a means of understanding multiple attributes as they cluster within preschool-aged children. Follow-up between-class analyses can identify differences in relations between predictors and other outcome variables among classes. Nevertheless, class membership is probabilistic and not synonymous with perfect classification. Latent classes offer heuristics to conceptualize complex phenomena, and these classes do not necessarily correspond to naturally occurring categories (Beauchaine, 2003; Drabick, 2009; Nagin & Tremblay, 2005). Variable-centered moderational analyses permit more explicit testing of the significance of different candidate variables in moderator roles, while still accounting for selected co-occurring variables. Thus, it is possible to speak more definitively about the effect of a particular variable in combination with others based on these variable-centered approaches. However, the variable-centered approach may not reflect the “true” patterns of variables as they cluster together. For example, multiple regression analysis generates values for an outcome variable based on the particular combination of predictor/moderator variables entered into the regression equation, even though the specified combination of variables may not occur often.

Comparison of results from person- and variable-centered frameworks suggests slightly different interpretations of the data. Person-centered analyses suggested that adaptive communication and/or child sex may be important moderating variables, given the stronger expressive language-behavior relation associated with the High Communication/Average Anger class, compared to the Typical Language/Higher Anger class. However, variable-centered analyses indicated that child sex was not a significant moderator, and high levels of adaptive communication did not significantly buffer behavioral risk among children with high anger/frustration. Rather, variable-centered analyses provided the strongest support for anger/frustration as a moderator, such that children with low anger/frustration evidenced a decrease in externalizing behaviors at high levels of expressive language, even in the context of low adaptive communication. However, latent class-specific analyses demonstrated that the class of children with the lowest levels of anger/frustration (i.e., Verbally Competent/Lower Anger) did not differ significantly from the other two classes in the magnitude of the expressive language-behavior relation.

Overall, there was agreement across person- and variable-centered results that preschool-aged children demonstrated significantly lower externalizing behaviors in the context of higher expressive language skill when they (a) also possessed another area of competency that may have increased their ability to use or access expressive language, and (b) had higher externalizing levels in the context of low expressive language, such that there was the opportunity for “improvement” in externalizing behaviors. This first conclusion allows both high adaptive communication and low anger/frustration to be considered examples of attributes that may support preschoolers’ later behavioral

development, given higher initial levels of expressive language. The latter conclusion helps to explain why neither the Verbally Competent/Lower Anger class nor the children with low anger/frustration and high adaptive communication evidenced significantly lower Time 2 behavior problems in the context of high expressive language, relative to other groups. It may be that neither had sufficient room for improvement to obtain a significant effect, even though both likely possessed sufficient competencies to access and use expressive language. Taken together, results from both analytic strategies carry implications for future work.

### *Clinical Implications*

Given the heterogeneity in preschool-aged children's behavior problems, language abilities, and other moderating factors, the identification of distinct subgroups of children has important clinical implications for identifying children for targeted early interventions by early childhood educators and other practitioners. Current patterns of special education referrals may not match children to services with a high degree of precision, as was illustrated by a study on special education referrals in Head Start. Approximately 70% of children referred for services had emotional-behavioral problems, and 30% had comorbid language and behavioral difficulties (Fantuzzo et al., 1999). Nevertheless, recommendations overwhelmingly involved receipt of services for language delay, rather than behavior problems, possibly reflecting teachers' hesitation to label children as "problem children." Thus, knowledge of expressive language's function within subgroups of children with different patterns of co-occurring attributes could facilitate (a) the identification of children for targeted early interventions and (b) the individualization of interventions in terms of content and/or format.

Results of the current study suggest that language-based interventions to address behavior problems may be most appropriate for children with other relative communicative or temperamental protective factors. In particular, children with low levels of temperamental anger/frustration—together with girls possessing strong communicative skills in the context of other average attributes—may be particularly amenable to such interventions. Within the broader domain of language-based work, children with lower adaptive communication abilities may benefit from a group-based intervention focused on building and applying expressive skills to social situations. For example, social-communicative improvements have been observed following a dyadic play-based intervention (Craig-Unkefer & Kaiser, 2002, 2003; Stanton-Chapman, Denning, & Jamison, 2008). Children with competent communicative skills may only require a more basic expressive language skill-building approach, consistent with traditional language therapy, given that they already may be sufficiently oriented toward verbal means of communication to apply their expressive skills in the classroom and among peers.

Children with higher levels of temperamental anger/frustration, particularly those without strengths in receptive language or adaptive communication, may benefit from an emotion-based intervention program to address self-regulatory competencies (Izard et al., 2008), prior to or in lieu of pursuing language-based intervention. Also, classroom management training may be helpful for teachers to provide a more structured class with clear behavioral contingencies (Raver et al., 2008), thereby supporting children's ability to develop self-regulation skills (e.g., Hyson, Hirsh-Pasek, & Rescorla, 1990). Moreover, a specific focus on the student-teacher relationship may be important to promote

preschool-aged children's behavioral and linguistic development, given linkages between positive teaching interactions with prekindergarten teachers and children's later language acquisition (Burchinal et al., 2008). Therefore, teacher-child interaction therapy may be appropriate for targeting children's classroom behavior and language development by addressing teachers' child-directed interactions, as well as classroom management skills (McIntosh, Rizza, & Bliss, 2000; Tiano & McNeil, 2006).

It is important to note that although the current study considered patterns of children's attributes that might indicate the appropriateness of language vs. behavioral interventions, this was not a treatment study. These clinical implications are speculative and must be empirically tested. Moreover, given the generally non-clinical ratings of externalizing behaviors in the present sample, the extent to which these implications might apply to clinical samples is not clear and a question for future research to address.

### *Strengths*

The present study addressed several methodological limitations in the literature concerning the co-occurrence of language difficulties and externalizing behavior problems in early childhood. First, the prospective design and high-risk community sample permitted the assessment of variations in language and behavioral functioning among typically developing preschool-aged children over a clinically relevant time period (i.e., one academic year). Second, the current study used a dimensional approach by examining externalizing behavior symptoms and continuous language scores, rather than language delay categories or clinical diagnostic categories. This less restrictive approach is useful for understanding language-behavior relations in a community sample, in which most children do not meet diagnostic criteria for specific language or psychiatric

diagnoses but may nonetheless exhibit symptoms that confer risk for impairment (Angold, Costello, Farmer, Burns, & Erkanli, 1999; Costello, Egger, & Angold, 2005). Third, due to careful consideration of inclusion/exclusion criteria for study enrollment, coupled with statistical control of covariates, it was possible to limit the influence of potentially confounding variables (e.g., nonverbal cognitive ability, neurodevelopmental delays) on expressive language and externalizing behaviors.

Multiple imputation and full information maximum likelihood estimation were used to handle missing data, thus enabling all participants to be included in analyses and avoiding ad-hoc missing data approaches such as listwise deletion that are more likely to bias analyses (Collins & Lanza, 2010; Schafer & Olsen, 1998). Also, the study employed both person-centered and variable-centered analytic strategies in an effort to identify relatively homogeneous subgroups and to link these subgroups to different behavioral outcomes as a function of expressive language. This approach permitted the identification of meaningful patterns of conceptually relevant moderating attributes that were associated with differences in the magnitude of the expressive language-behavior relation.

A final strength of the current study is its use of a developmental psychopathology framework to understand variability in hypothesized relations between expressive language and behavior, rather than to seek out a single explanation that may not account for heterogeneity among preschoolers with language and behavior difficulties. To my knowledge, this study is unique in the language-behavior field in that it used a person-centered analytic strategy to identify subgroups of preschoolers based on both language and associated non-language latent class indicators. Thus, the current study

builds on previous research examining a single moderator of general language risk (e.g., Bowman et al., 2006). Results suggest that it is important for language-behavior researchers to move beyond designs that compare two or more types of language impairment (e.g., Beitchman et al., 1989; Willinger et al., 2003), collapse types of language impairment (e.g., Brownlie et al., 2004; La Paro, Justice, Skibbe, & Pianta, 2004), or consider competing, mutually exclusive explanations for the relation between language and behavior problems (e.g., Pine et al., 1997).

#### *Limitations and Future Directions*

Several limitations of this study need to be considered as well. Although it was expected that the base rates of externalizing behavior problems and language delay would be low in a community-based sample, the rates were lower than expected given previous studies in Head Start samples (Qi & Kaiser, 2004). It is possible that the study's inclusion/exclusion criteria may have limited the enrollment of children with greater impairments. However, it also may be that the children who attended the semi-rural Head Start centers sampled in the current study differ substantially from those who attend urban centers and who are commonly included in child development research. Thus, results from the current study may not be generalizable to Head Start populations in general.

The current study's sample size, although considered acceptable for latent class analysis, may have been too small to detect the four-class solution that was originally hypothesized. Also, power limitations may have precluded the detection of significant effects in variable-centered analyses, particularly as effect sizes of expressive language were smaller than expected. These concerns were mitigated to some extent by the

application of bootstrapping to increase confidence in the sampling distribution of relevant parameters. Future studies with larger sample sizes may lead to selection of different latent class solutions and consequently a different pattern of results, though this is ultimately an empirical question.

Teachers reported on both externalizing behaviors and adaptive communication. Although assessments were not conducted concurrently, this shared method variance may have contributed to the significant associations between these constructs. Also, temperamental anger/frustration was assessed by caregiver report; it may have been preferable to assess one or more of these constructs using laboratory tasks and/or direct observational methods to potentially attenuate biases associated with the use of adult informants.

The goals of the current study were confined to understanding the influence of expressive language on later classroom behavior. Therefore, moderating parental, familial, and contextual variables were not assessed, and it was not possible for the study to test or to rule out the effects of non-language variables on later behavior problems. Multilevel, ecological models of development (e.g., Bronfenbrenner, 1979) indicate that child and contextual risk factors exert shared and interactive effects on children's outcomes (Drabick, 2009; Rutter & Sroufe, 2000). Given that other variables (e.g., linguistic expressiveness in the home, parent-child interactional processes) have been suggested as important contextual influences in shaping children's linguistic and behavioral competencies (Carpenter & Drabick, 2010), these factors should be assessed and studied systematically in future work.

Although I tested temperamental anger/frustration, receptive language, and

adaptive communication as moderators of the relation between expressive language and externalizing behaviors, it is possible that these variables may operate in alternate roles (e.g., as shared risk factors). For example, high levels of temperamental anger/frustration may predispose children to both language and externalizing behavior problems (Carpenter & Drabick, 2010). Also, the current study assessed children at only two timepoints and thus was not equipped to model trajectories of children's externalizing behavior problems and language abilities over time. Such studies could advance knowledge about the temporal relations between language and behavioral variables for specific subgroups of children, as well as provide information about the strongest predictors of developmental outcomes for different subgroups (e.g., anger/frustration, adaptive communication). Because such predictors may confer resilience from developing co-occurring behavior problems in the context of language difficulties, the identification of these attributes could inform prevention programs to promote children's behavioral health in preschool.

Such work also has the potential to identify optimal timing for intervention by noting time points during the year when subgroups of children evidence problems that may be somewhat impairing but not yet clinically significant. Finally, for those subgroups of children that evidence either increasing or decreasing trajectories of language and/or behavior problems over time, studies should test predictors and mediators of change. It also will be important for future research to test mediators of the relation between expressive language and externalizing behaviors. Candidate mediators that have been proposed include peer victimization (Dionne et al., 2003; Menting et al., 2011), low social competence (Horwitz et al., 2003), and limited opportunities for social-

linguistic growth (Carpenter & Drabick, 2010). Understanding the processes that underlie prospective relations between expressive language and behavior could directly inform subgroup-specific interventions and our understanding of risk and resilience for co-occurring expressive language and externalizing behavior difficulties.

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