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Associations between Toddler-age Communication and Kindergarten-age Self-regulatory

Skills

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ABSTRACT

Purpose: The study aimed at gaining understanding on the associations of different types of early language and communication profiles with later self-regulation skills utilizing longitudinal data from toddler-age to kindergarten-age.

Method: Children with early language profiles representing *expressive* delay, *broad* delay (i.e., expressive, social, and/or symbolic), and *typical* language development were compared in domains of kindergarten-age executive and regulative skills (attentional/executive functions, regulation of emotions and behavioral activity, and social skills) assessed with parental questionnaires.

Results: Children with delay in toddler-age language development demonstrated poorer kindergarten-age self-regulation skills than children with typical early language development. Broad early language delays were associated with compromised social skills and attentional/executive functions, and early expressive delays were associated with a generally lower level of kindergarten-age executive and regulative skills. Regression analyses showed that both earlier and concurrent language had an effect especially on the attentional/executive functions.

Conclusions: The findings suggest that different aspects of toddler-age language have differential associations with later self-regulation. Possible mechanisms linking early language development to later self-regulative development are discussed.

Keywords: prelinguistic communication and language, early language delay, self-regulation

Associations between Toddler-age Communication and Kindergarten-age Self-regulatory

Skills

A range of self-regulatory skills, such asattentional/executive regulation and

regulation of behavior, emotions, and social interchanges, are needed for competent

functioning in the home, school, and social community (see Bronson, 2000). Weaknesses in

these skills have been associated with negative outcomes in a range of domains such as social

adjustment (for a review, see Vohs & Ciarocco, 2004) and academic success (Schunk &

Zimmerman, 1997, 2007). The maturation of self-regulation is influenced by the emergence

of early cognitive skills including attention (e.g., Posner & Rothbart, 2000), representative

memory, and inhibition (Barkley, 1997, 2021; Wolfe & Bell, 2007). An additional domain of

specific interest is language, which is assumed to pave the way for the development of

regulatory skills by providing the psychological tools needed to gain mastery over behavior

and cognition (see Kopp, 1982; Vygotsky, 1962). Although documentation of behavioral,

emotional, and social difficulties (e.g., Lindsay, Dockrell, & Srand, 2007; St Clair, Pickles,

Durkin, & Conti-Ramsden, 2011), and attentional or executive deficits (e.g., Henry, Messer,

& Nash, 2012) among children with language impairments attest to the association between

language and self-regulatory development, understanding of the developmental mechanisms

behind this association is scarce and fragmented. In the present study, we investigated the

associations between toddler-age communication and language skills and self-regulation in

kindergarten-age.

Self-regulation is seen as an integrative construct encompassing three interrelated

internally-directed capacities (see Blair, 2010; Blair & Raver, 2012; Bronson, 2000; Raffaelli,

Crockett, & Shen, 2005): regulation of cognitive processes, regulation of emotions and

affective reactions, and regulation of behaviors. The interwoven nature with regard to

manifestations of developmental difficulties is sometimes emphasized as in the term BESD

used for behavioral, emotional, and social difficulties (e.g., Lindsay et al., 2007; St Clair et al., 2011). Studies aiming at gaining access to the cognitive processes underlying executive functions typically utilize neuropsychological testing of the component skills (i.e., attentional flexibility, inhibitory control, working memory, and planning; see e.g., Hughes, Ensor, Wilson, & Graham, 2010; Miller, Giesbrecht, Muller, McInerney, & Kerns, 2012), in the present study, however, the focus is on the behavioral level of successfully utilizing the self-regulative processes in one's proximal contexts. Thus, children's *executive and regulatory skills* were assessed in the present study with parental questionnaires tapping the following five areas: (1) regulation of cognitive processes (scales tapping on attentional/executive functions, i.e., directing, sustaining, and shifting attention, and planning one's actions), regulation of emotions manifested as (2) internalizing or (3) externalizing symptoms, and regulation of behavior manifested in (4) behavioral activity (scales tapping on impulsivity and motor activity) and in (5) prosocial skills (scales tapping on low cooperation, assertiveness, and responsibility).

Empirical evidence on the associations between language and executive and regulatory skills is mainly available for populations with *specific language impairments* (SLI; for review see Yew & O'Kearney, 2013). Language impairment has been shown to be related to poor social skills (Botting & Conti-Ramsden, 2008; Clegg, Hollis, Mawhood, & Rutter, 2005; Durkin & Conti-Ramsden, 2007; Fujiki, Brinton, & Clarke, 2002; Hart, Fujiki, Brinton, & Hart, 2004; Lindsay et al., 2007; St Clair et al., 2011), deficient emotion regulation (Fujiki et al., 2002; Fujiki, Spackman, Brinton, & Hall, 2004; St Clair et al., 2011), and behavioral regulation (Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006; St Clair et al., 2011; van Daal, Verhoeven, & van Balkom, 2007). Associations between language impairment and difficulties in executive functions have been studied to a lesser extent, but the evidence

suggests a link between them (e.g., Henry et al., 2012; Marton, 2008; Westby & Cutler, 1994).

Most of the studies on the association between language impairment and self-regulatory skills have focused on school-age children and employed cross-sectional designs. Longitudinal evidence on the associations between early language impairment and subsequent executive and regulative skills is limited. The bulk of the longitudinal evidence concerns children identified as *late talkers*, i.e., manifesting early expressive delay which does not necessarily persist. Despite the equivocal findings, the literature tends to provide stronger support for an association between expressive vocabulary delay and internalizing behaviors, especially withdrawal, than for externalizing behaviors. Some studies indicate no differences between late talkers and children with typical language in attention and impulsiveness (D'Odorico, Assanelli, Franco, & Jacob, 2007) or fail to find evidence for expressive vocabulary delay at the age of two years being a risk factor for later behavioral and emotional disturbances (Whitehouse, Robinson, & Zubrick, 2011; see also Rescorla, Ross, & McClure, 2007).

In their longitudinal study, Paul and Kellogg (1997) showed that late talkers (children with slow expressive language development at two years of age) were rated to be more withdrawn at six years of age than their peers with a history of normal language development. A higher incidence of internalizing symptoms (e.g., anxiety, depression, withdrawal; Carson, Klee, Perry, Muskina, & Donaghy, 1998), and social withdrawal (Rescorla et al., 2007) have been found among children with expressive language delays than typically developing toddlers also in cross-sectional studies. In line with the findings above, Irwin, Carter, and Briggs-Gowan (2002) showed that late talkers were rated by parents as more withdrawn and less compliant than toddlers without delay, but no differences were found for externalizing behaviors or for peer relationships

Studies among children with *reading disabilities* or at risk for them indicate that linguistic difficulties—manifesting themselves as slow acquisition of accurate and fluent decoding of letters to sounds and word recognition—have been found to co-occur with difficulties in psychosocial functioning (Snowling, Muter, & Carroll, 2007) and executive functions/working memory (Helland & Asbjornsen, 2000; Reiter, Tucha, & Lange, 2005). Aro, Eklund, Nurmi, and Poikkeus (2012) showed an association between toddler-age language skills and later social skills among children with and without familial risk for reading difficulties, and among at-risk children behavioral regulation skills were found to mediate the association between toddler-age language skills and later social outcomes.

Rather surprisingly only few of the longitudinal studies investigating both language and self-regulatory skills have considered the participants' concurrent language skills although emotional/behavioral and language development are complexly intertwined throughout lifespan. As an example of these rare studies Paul and Kellog (1997) found that both earlier (4 years) and concurrent (6 years) scores for mean length of utterance were associated with child's approach/withdrawal ratings at six years of age. Snowling and colleagues (2007) found raised incidence of attention and social difficulties among those children whose early language delay persisted to adolescence, and adolescent social difficulties were associated with concurrent receptive and expressive language and attention problems with expressive language. Recently, Vallotton and Ayob (2011) found—using growth modeling—that both concurrent (36 months) and prior (24 months) vocabulary predicted children's levels of self-regulation (at 36 months), and the effect was not eliminated by children's cognitive abilities, age, or mother's vocabulary.

Literature regarding children with SLI is fragmented with respect to different areas of language development. In some studies focus has been on either mixed receptive, receptive, or expressive language impairments (e.g., Botting & Conti-Ramsden, 2008; Durkin & Conti-

Ramsden, 2007; Snowling et al., 2006), and in some studies on more specific aspects of language (e.g., van Daal et al., 2007 on phonology, speech, semantics, and, syntax). The findings suggest that receptive difficulties are associated with poor friendship quality (Durkin & Conti-Ramsden, 2007) and with poor social outcomes in adolescence (Botting & Conti-Ramsden, 2008); expressive difficulties have been associated e.g., with attention problems (Snowling et al., 2006); phonological problems with behavioral problems (van Daal et al., 2007), and semantic difficulties with internalizing behavior (van Daal et al., 2007).

In sum, earlier findings suggest that difficulties in language development are associated with difficulties in later development of executive and regulative skills, most consistently in the realm of social skills. Deficits in early expressive language skills often seem to be associated with later social withdrawal or internalizing symptoms, whereas broader or more severe and persistent difficulties in language development (i.e., SLI) are associated with a range of executive and regulatory difficulties (i.e., attentional/executive, emotional, behavioral, and social). Present knowledge on the associations between different aspects of language development and specific areas of executive and regulative skills is still in dearth. Therefore, we need to better understand the language modalities that are affected or mediate the associations between different areas of development (see Conti-Ramsden, 2013; Petersen, Bates, D'Onofrio, Coyne, Landford, Dodge, Petit, & van Hulle, 2013; Yew & O'Kearney, 2013).

The aim of the present study was to gain an understanding of the development of executive and regulative skills among children manifesting a different profile of pre-linguistic communication. The study contributes to the literature by utilizing an empirically derived subgrouping of early communication and language profiles of a population based sample, and comparing the subgroups on several aspects of executive and regulatory skills in kindergarten-age three years later as well as controlling for the role of current language. By

using a measure of very early communication as the starting point we aim to identify risks which would be theoretically linked with evolving self-regulation, and which would aid in identifying children who might benefit from family support for interaction, language skills and self-regulation.

Our longitudinal data comprised parental ratings of early toddler-age language and communication (early expressive, symbolic, and social communication) and parental ratings of kindergarten-age (4 years 7 months) executive and regulative skills (attentional/executive functions, regulation of emotions, regulation of behavioral activity, and social skills). The subgrouping of children into toddler-age communication and language profiles was based in an earlier study (Määttä, Laakso, Tolvanen, Ahonen, & Aro, 2012) in which Latent Profile Analysis (LPA) was applied in the data to identify developmental trajectories. In the present study, we compared children with differential early profiles: (1) *expressive* communication and language delay, (2) early *broad* communication and language delays (i.e., expressive, social, and/or symbolic), and (3) *typical* early communication and language development in several domains of executive and regulative skills.

Based on the SLI literature (e.g., Hart et al., 2004) and the literature on late talkers (e.g., Paul & Kellogg, 1997), we expected children with early communication and language delays (broad or expressive) to have poorer executive and regulatory skills than the typically developing children, particularly in the domain of socially skilled behavior. More specifically, we expected that children with broad communication and language delays in toddler-age would show deficits in several executive and regulatory skills later on (e.g., van Daal et al., 2007), and that their difficulties would be especially manifested in attentional/executive functions (e.g., Henry et al., 2012). On the other hand, we expected that children with expressive delay in toddler-age would show more internalizing problems than

children with typical development (c.f., literature on late talkers e.g., Paul & Kellogg, 1997; Rescorla et al., 2007).

Method

Participants

The participants (n = 185) represent a subsample of a community-based sample (N = 508) collected in a longitudinal study of language and communication development in Central Finland (see Määttä et al., 2012). The recruitment was carried out through community-based child health care clinics (introduction of the questionnaire was carried out by the nurses of the clinics). These clinics serve families free of charge and they are attended by over 95% of Finnish parents and their children. All clinics in the area of the city of Jyväskylä (a population base of close to 100,000, and an age-cohort of about 900 at the time) volunteered to participate in the study, and all families with children between 6 and 24 months of age visiting the clinics during the year 2003 were invited to participate.

Altogether, 508 children (50.2% boys, 49.8% girls) participated in the study. After giving their consent and completing the Infant/Toddler Checklist for the first time (ITC; part of the Communication and Symbolic Behavior Scales Developmental Profile CSBS-DP, Wetherby & Prizant, 2002), the families were asked to complete the questionnaire every three months until their children were 24 months of age (i.e., maximum of seven times; at 6, 9, 12, 15, 18, 21, and 24 months). The number of age phases that were completed varied depending on the age of the child when the first questionnaire was completed. Data were available for at least three time points for 67.9% of the children.

All of the families were contacted again for a follow-up when their children were 4 years 7 months of age. Each family was sent a new questionnaire, which included scales assessing executive and regulatory skills and language. Of the original 508 families, 473 could be contacted and 296 (62.6%) of them returned the questionnaire.

In an earlier study on the same data (Määttä et al., 2012) latent profile analysis (LPA) was used to identify subgroups among the children on the basis of the three composites (social communication, speech, and symbolic behaviors) of the Infant/Toddler Checklist (ITC) gathered between 12 and 21 months of age. A maximum of four age points were used in the LPA, and children were excluded from the LPA analyses if their data were missing in two of the four age points measured: at 12 and 15 months of age, at 18 and 21 months of age, or at 12 and 21 months of age. The application of this criterion resulted in a sample of 271 children.

The LPA (for details, see Määttä et al., 2012) resulted in six toddler communication subgroups: three subgroups with at least average development and three subgroups with lower than average development in the three ITC domains. The three subgroups identified in the LPA as having average development were as follows: group 1 had average development in all three domains (within +/- 0.5 SD from the grand mean), group 2 had above average in all three domains (at least + 0.5 SD above the mean), and group 3 had average development in expressive and symbolic communication but a lower than average skills in the social composite at 18 months (see Määttä et al., 2012). In the present study these were combined into one group, termed as the *typically developing group* (TD).

The LPA (Määttä et al., 2012) identified the following three subgroups with lower than average development: (1) children with slower than average development in expressive language skills (i.e., speech composite), named hereafter as *expressive delay group, ED* (c.f., late talkers); (2) children with slower than average development in all three composites of communication during the period from 12 to 21 months; and (3) children whose expressive skills were within age range but who showed increasing delay in the domains of symbolic behavior and social behavior. In the present study the latter two groups (i.e., children

demonstrating broader than only expressive delay) were combined into one group: *broad delay group (BD)*.

The present data consisted of 185 (95 boys and 90 girls) children for whom we had both the toddler-age communication group profiles (either ED, BD, or TD) and the parental ratings of executive and regulative skills at 4 years 7 months of age. Two girls belonging to the TD group were excluded from the analyses as they had outlier and possibly erroneous values on internalizing problems (i.e., *z*-score below -5.0 only in this scale suggesting misinterpretation of the scale). The typical development group (TD, 63 boys and 65 girls) was compared with the two groups with compromised development (i.e., BD comprising 18 boys and 27 girls and ED comprising five boys and seven girls) to gain information on whether the developmental trajectories of toddler-age communication and language were differentially associated with aspects of later executive and regulative skills.

Parents were asked about their level of vocational education on a 7-point scale (0 = *no vocational education*; 6 = *licentiate or doctoral university degree*) at the time of entry to the study (i.e., when the child was between 6 and 24 months old). A total of 4.9% of mothers (and 4.3% of fathers) (general population 6%) had no vocational education; 1.6% of mothers (and 2.7% of fathers) had attended short vocational courses; 16.2% of mothers (and 21.1% of fathers) had a vocational school qualification; 19.5% of mothers (and 20.5% of fathers) had a vocational college qualification; 12.4% of mothers (and 27.8% of fathers) had a polytechnic degree or bachelor's degree; 40.0% of mothers (and 24.9% of fathers) had a master's degree; and 5.4% of mothers (and 7.6% of fathers) had a licentiate or doctoral degree. Other family-data (available for 171 families, collected when the first ITC questionnaire was filled) indicated that 97 (56.7%) of the children were firstborns, and 74 children had older siblings in the family. At the time when the parents entered the study and provided the first ratings

concerning their child's language development (between 6 and 24 months) 174 (98.3%) of the 177 families reporting their family status were families with two parents.

Measures

In the present study four parental questionnaires were used to study toddler-age language and kindergarten-age language and executive and regulative skills: one administered at toddler-age and three administered at kindergarten-age. Two of the questionnaires, the Infant/Toddler Checklist (ITC; Wetherby & Prizant, 2002) and the Social Skills Rating Scale (SSRS; Gresham & Elliott, 1990), were translated and back-translated from English into Finnish in the course of the longitudinal study together with the measure's original publisher or the author. No local norms were available for these two questionnaires. The Attention and Executive Function Rating Inventory (ATTEX; Klenberg, Jämsä, Häyrinen, Lahti-Nuuttila, & Korkman, 2010) had recently been published in Finland for school-age children and norms for kindergarten-aged children were not yet available. The Five-to-Fifteen questionnaire (FTF; Kadesjö et al., 2004) developed in Nordic collaboration has been published in Finnish by Korkman, Jaakkola, Ahlroth, Pesonen, and Turunen (2004).

In addition to toddler-age language and kindergarten-age executive and regulative skills, we provide some descriptive data on the children's language skills at 4 years 7 months as rated by the parents using the FTF (available for the whole sample, $n = 185$) and on the children's cognitive and language skills at 5 years and 3 months using subtests of standardized neurocognitive tests (NEPSY-II, Korkman, Kirk, & Kemp, 1997; WPPSI-R Wechsler, 1989; data available only for about half of the sample, $n = 90$).

Toddler-age questionnaire: The Infant/Toddler Checklist (ITC). Toddler-age communication and language skills were assessed using the Infant/Toddler Checklist of the Communication and Symbolic Behavior Scales Developmental Profile (ITC/CSBS-DP; Wetherby & Prizant, 2002). The ITC is a screening tool assessing prelinguistic milestones in

children aged 6 to 24 months. The checklist is completed by a caretaker who nurtures the child on a daily basis, and it takes about 10 minutes to complete. The ITC consists of 24 questions that measure seven communication clusters, which are organized into three composites. The Social Communication composite consists of questions concerning emotion and the use of eye contact (four items), communication (four items), and gestures (five items). The Speech composite measures sounds (three items) and words (two items) produced by the child. The Symbolic Behavior composite assesses understanding (two items) and object use (four items). The ratings are given either on a 3-point scale (1 = *not yet*, 2 = *sometimes*, 3 = *often*), or on a scale describing a series of numbers or ranges affording 0 to 4 points (e.g., 0 = *none*, 1 = *1-3*, 2 = *4-10*, 3 = *11-30*, 4 = *over 30*). The United States version of the manual indicates a high degree of internal consistency (i.e., Cronbach's alphas over all age-groups ranging from .87 to .93; Wetherby & Prizant, 2002). In the larger longitudinal dataset (*n* = 269-320) from which the present data were drawn, the Cronbach's alphas at the ages 12, 15, 18, and 21 months (based on sample sizes ranging from 269 to 320) ranged from .70 to .74 for the Social Communication composite, from .46 to .63 for the Speech composite, and from .47 to .58 for the Symbolic Behavior composite.

Kindergarten-age Questionnaires.

Both language and executive and regulative skills were assessed with parental questionnaires at the age of four years and seven months. Five composite scores were formed from the pre-existing scales described below (FTF, ATTEX, and SSRS) to assess executive and regulative skills. The five composite scores were formed based on the prevailing view that self-regulation encompasses several distinct but overlapping areas: regulation of cognitive processes, regulation of emotions and affective reactions, and regulation of behaviors (see Blair, 2010; Blair & Raver, 2012; Bronson, 2000; Raffaelli et al., 2005). Behavioral manifestation of regulation of cognitive processes was assessed with scales

tapping directing, sustaining, and shifting attention, and planning one's actions. Regulation of emotions at the behavioral level was measured with subscales capturing internalizing and externalizing symptoms. Regulation of behavior was measured with subscales capturing regulation of behavioral activity and prosocial skills. In the selection of subscales from the FTF, ATTEX, and SSRS we first identified subscales and items overlapping in content (e.g., "Answers before listening to the whole questions" of the FTF hyperactivity/impulsivity subscale and "Listens to instructions" of the SSRS self-control subscale) or correlating highly with each another and only those were selected which tapped constructs distinct from each other. The scales and the selected subscales are described in detail below.

Five-to-Fifteen (FTF). The FTF (Kadesjö et al., 2004; Korkman et al., 2004) is a parent questionnaire developed by a Nordic multidisciplinary research group for assessment of a broad range of childhood behavioral and developmental problems (e.g., language difficulties, behavioral problems, problems in gross and fine motor skills, visuo-spatial perception, and memory) in children aged 5 to 15 years. Altogether, it comprises 181 items that are rated using a 3-point scale (0 = *does not apply*, 1 = *applies sometimes or to some extent*, 2 = *definitely applies*). In the analyses of the present study we included the following two FTF scales: the language scale (comprising 21 items) and the hyperactivity/impulsivity scale (comprising nine items; see Table 1). The language scale can be divided to three subscales: expressive language skills (comprising 5 items), comprehension (comprising 12 items), and communication (comprising 3 items) which were also used in the present study to analyze the effect of concurrent language skills on the executive and regulative skills. Kadesjö and colleagues (2004) reported the Cronbach's alpha for the language scale to be .91 (for the subscales respectively .84, .84, and .75) and for the hyperactivity/impulsivity scale it was .88. In the larger longitudinal dataset ($n = 290 - 292$) from which the present data were

drawn from, the Cronbach's alpha was .86 for the language scale and .79 for the hyperactivity/impulsivity scale.

   Attention and Executive Function Rating Inventory (ATTEX). The ATTEX (Klenberg et al., 2010) questionnaire is a rating scale with 55 items describing difficulties of inhibition (three scales, e.g., impulsivity, motor hyperactivity), attention (three scales; Ddirecting attention, sustaining attention, shifting attention), and EF (four scales, e.g., planning, execution of action, evaluation) grouped under 10 clinical scales. The ratings are given on a 3-point Likert scale (''*not a problem*'', ''*sometimes a problem*'', ''*often a problem*''). In addition, ATTEX includes the reporting of the strengths of the child, and situational variation of EF, which were not used in the current study. In the analyses of the present study we included the following six ATTEX scales: two inhibition scales to provide a measure of children's behavioral problems (impulsivity and motor restlessness), three attention scales (directing attention, sustaining attention, and shifting attention), and one EF scale (planning) to provide a measure of children's attentional/executive functions. The number of items on the selected scales ranged from three items (e.g., planning) to nine items (impulsivity). The first author of the ATTEX modified the scales and the wordings of the items for the purposes of the present study to suit preschool-age children. The ATTEX scales have been found to have good internal consistency reliability (.67 – .98) and criterion validity (.68 – .95) (Klenberg et al., 2010). In the larger longitudinal dataset ($n = 293$) from which the present data were drawn from, the Cronbach's alphas varied between .64 and .75.

   Social Skills Rating Scale (SSRS). The Social Skills Rating Scale – Preschool Level (Gresham & Elliott, 1990) is commonly used to evaluate a range of socially validated behaviors using preschool teachers, parents, and students as the rater. It can be used to assess children who have problems with behavior and interpersonal skills. The SSRS was used in the present study to assess social behavior (cooperation, assertiveness, and responsibility

scales) and emotional problems (internalizing problem and externalizing problem scales). The alpha reliabilities of the SSRS have been found to be good. In a comprehensive study by Feil and colleagues (2005), the coefficient alpha reliability was.73 for the parent form (see also Gresham & Elliott, 1990). In the larger longitudinal dataset ($n = 269 – 295$) from which the present data were drawn from, the Cronbach's alphas varied between .68 and .73.

Psychometric Properties of the Executive and Regulative Scores

The final number of items used to form the five executive and regulative scores used in the present analyses as well as the alphas are presented in Table 1. The internal reliability of the formed scales was analyzed using Cronbach's alpha. Reliabilities were either good or satisfactory (ranging between .66 and .88). In the analyses, *z*-scores calculated based on the present data were used since local norms were not available for all the measures used (see above); higher *z*-scores indicated better performance in all the executive and regulative problem scores. The data concerning the whole sample was used as the reference group in the norming instead of just using the subgroup with typical early communication and language development. This was based on two reasons: bigger sample size and representativeness in terms of the outcome measure.

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Insert Table 1 about here

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The composite score for *attentional/executive functions skills* was formed from the following ATTEX scales: directing attention, sustaining attention, shifting attention, and planning (see Table 1). The *regulation of emotions* scale consisted of the SRSS internalizing and externalizing symptoms scales. Due to low correlations between these two scales ($r = .23$), they were used separately. Items comprising *regulation of behavioral activity* were derived from the following scales: Impulsivity and motor restlessness from the ATTEX and

impulsivity from the FTF. The composite score for *social skills* was formed from the

following SSRS scales: cooperation, assertiveness, and responsibility.

Data Analyses

In an earlier study (for details, see Määttä et al., 2012) the LPA was performed using

the MLR (maximum likelihood with robust standard errors) estimation method implemented

in the Mplus program version 5.1 (Muthén & Muthén, 1998-2007). This modeling aims to

identify latent classes and estimate their parameters (Muthén & Shedden, 1999; Muthén,

2001). The LPA resulted in a solution of six meaningful prelinguistic communication

subgroups: three subgroups with at least average development in the three domains of

communication and language and three subgroups with lower than average development.

These subgroups were clearly distinguishable, both theoretically and based on Entropy (.891)

and Average Latent Class Posterior Probabilities (AvePP, range .90-.99; for details, see

Määttä et al., 2012).

In the present study, the executive and regulative skills of the three groups (ED, BD,

and TD) formed on the basis of the LPA were compared. A non-parametric Kruskal-Wallis

test (with Monte Carlo simulation) was used due to the small number of children in the

groups with early delays (ED and BD). Pairwise comparisons were used to analyze the

specific pairs for significant differences in cases where the omnibus Kruskal-Wallis test

indicated a significant difference. Effect sizes for the pairwise comparison were calculated as

follows: $r = Z/_{\text{sqrt}}N$ (see Field, 2009; $r = 0.1$ indicating small, $r = 0.3$ indicating medium, and r

$= 0.5$ indicating large effect size).

Hierarchical regression analysis with two steps was used to analyze the effect of early

and concurrent language. First, means of the ITC speech, symbolic and social composite

scores across the 12, 15, 18, and 21 months' data were calculated, and these means were then

used in the first step of the regression analysis to analyze the association between the early

language skills and later executive and regulative skills. The FTF scores of the expressive

language skills, comprehension, and communication scales were used in the second step of

the regression analysis to analyze whether the concurrent language had an incremental effect

after controlling for the effect of early language skills.

Results

We will first present descriptive data shedding light on the children's overall language

development after toddler-age using measures available in the data set: (1) the parental

ratings of communication and language skills using the Five-to-Fifteen scale (assessed

concurrently with the executive and regulative skills at 4 years 7 months), (2) neurocognitive

test data on language skills and cognitive skills on a subset of the same children (assessed at 5

years 3 months). The parental FTF Language scale scores ($min = 0$, $max = 2$, lower score

indicating fewer difficulties) for the three groups are seen the Table 2. The TD group was

rated as having the least problems followed by the BD group, and the ED group raw score

indicated most problems. The non-parametric Kruskal-Wallis test (with Monte Carlo

simulation) indicated a statistically significant difference between the groups ($\chi^2(2) = 23.33$;

$p = .000$), and the pairwise tests indicated significant difference between the ED and TD

groups ($p = .000$; adjusted $p = .000$; $r = .29$) and between the BD and TD groups ($p = .004$;

adjusted $p = .011$; $r = .32$). The ED and BD groups did not differ from each other in the

parental language ratings. Parents reported a diagnosis of delayed language development for

two children (1.5%) of the TD, for two children (16.7%) of the ED group, and for six

children (13.3%) of the BD group. ADHD, autism or other mental development or psychiatric

diagnoses were not reported for any of the children.

Individual language assessments at 5 years and 3 months were available for

approximately half ($n = 90$) of the participants. In the Sentence Repetition test (Nepsy-II;

Korkman et al., 1997), the mean scores indicated that the TD group ($n = 55$; see Table 2) had

the best performance, whereas the performance of the ED group ($n = 6$) was somewhat lower, and the performance of the BD group ($n = 29$) was the lowest. All group means were within the age-range, but the non-parametric Kruskal-Wallis test (with Monte Carlo simulation) indicated a statistically significant difference between the groups ($\chi^2(2) = 11.04$; $p = .004$). The pairwise tests indicated no significant difference between the ED and TD groups or the ED and BD groups, but indicated a significant difference between the BD and TD groups ($p = .001$; adjusted $p = .003$; $r = .36$).

Very similar results (i.e., BD group differing form the TD group) were found for the Nonsense Word Repetition subtest of the Nepsy-II and the Similarities as well as the Digit Span subtests from the WPPSI-R (Wechsler, 1989; see Table 2) indicating lower performance level for the BD group. The WPPSI-R Block Design subtest measuring non-verbal cognition (e.g., ability to analyze and synthesize an abstract design and reproduce it) showed no difference between the groups. The trend for poorer scores in language and memory tests for the BD than the ED groups suggests that although parents indicated worry regarding both non-typical groups, only the BD group children showed difficulties also in psychological tests compared to the TD group.

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Insert Table 2 about here

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Executive and Regulative Skills at Kindergarten-age

The correlations between the executive and regulative skills scores varied from $r = .13$ to $r = .54$ (see Table 3) suggesting that the scales were correlated, but still measured different aspects of executive and regulative skills. Table 4 presents the means and SDs of the executive and regulative skills scores by gender separately for all three groups (BD, ED, and TD). The mean scores were lowest for the ED group: the scores ranged between $z = -.65$ and

$z = -.40$, whereas the means for the BD group were higher ranging between $z = -.31$ and $z = .07$ (see Table 4). The group means for the TD group were all close to zero.

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Insert Tables 3 and 4 about here

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Differences between the two at-risk groups with early delays (BD and ED), and the typical development group (TD) were analyzed with the non-parametric Kruskal-Wallis test (with Monte Carlo simulation). A statistically significant group difference emerged for attentional/executive functions ($\chi^2(2) = 6.99$; $p = .030$), internalizing ($\chi^2(2) = 6.38$; $p = .041$) and externalizing ($\chi^2(2) = 6.50$; $p = .039$), and social skills ($\chi^2(2) = 12.54$; $p = .002$).

The pairwise tests indicated more internalizing ($p \leq .012$; adjusted $p \leq .035$; $r = .21$), a trend for more externalizing problems ($p \leq .051$; adjusted $p \leq .152$; $r = .16$), and lower social skills ($p \leq .007$; adjusted $p \leq .020$; $r = .22$) for the ED group than for the TD group. The BD group had poorer attentional/executive functions ($p \leq .017$; adjusted $p \leq .051$; $r = .18$) and lower social skills ($p \leq .008$; adjusted $p \leq .024$; $r = .19$), and somewhat more externalizing symptoms ($p \leq .056$; adjusted $p \leq .167$; $r = .15$) than the TD group. The comparison of the two at-risk groups indicated that the ED group had more internalizing problems than the BD group ($p \leq .035$; adjusted $p \leq .105$; $r = .28$). The overall lower profile of the ED group is seen in Figure 1.

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Insert Figure 1 about here

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Early vs. concurrent language

In order to determine whether executive and regulative skills could be attributed to children's concurrent language skills at four years and seven months of age, hierarchical

regression analysis with two steps was conducted separately for each executive and regulative skill score. Before the analysis, mean scores were calculated from the ITC composites (social communication, speech, and symbolic behaviors) from the 12, 15, 18, and 21 months data, i.e., means of these four age points were used. These three early communication and language variables were entered to the equation as the first step of regression (stepwise method) to see which of them were associated with executive and regulative skill scores. As the second step, the three FTF language scores (expressive language skills, comprehension, and communication) were entered to the equation (stepwise method) to see whether they had an effect on the executive and regulative skill scores over and above (i.e., an incremental effect) the effect of the three ITC variables entered in the first step.

The regression analyses indicated that concurrent language had a significant association with most of the executive and regulative skills (see Table 5). The Change R^2 of the concurrent language variables varied between 0 and .263, and Change R^2 of the early language variables varied between 0 and .097. The effect of concurrent language was strongest for attentional/executive functions: The analyses showed that both earlier and concurrent variables had an effect on the attentional/executive functions, but concurrent language scores increased the R^2 substantially (Total $R^2 = .425$). The only executive and regulative score that was not associated with early language scores, and thus, was only associated with concurrent language scores, was behavioral activity (Total $R^2 = .100$), and the only executive and regulative score not being associated with concurrent language scores was externalizing problems (Total $R^2 = .051$).

Of the early scores, the ITC speech composite was most often associated with the executive and regulative scores (i.e., internalizing, externalizing, and social skills), but the variances explained by it were mainly small (Change R^2 ranging from .024 to .097; see Table 5). Of the concurrent language scores, the FTF comprehension and communication scores

were most often associated with the executive and regulative scores (i.e., attentional/executive, internalizing, behavioral activity, and social skills; Change R^2 ranging from .026 to .263), whereas the concurrent FTF expressive language score was associated only with the internalizing score. In sum, the strongest evidence for the association between language and executive and regulative skills was found for attentional/executive functions (Total $R^2 = .425$), and weakest evidence was found for the externalizing symptoms (Total $R^2 = .051$).

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Insert Table 5 about here

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Discussion

This study examined the association between toddler-age language development and kindergarten-age executive and regulative skills. On the basis of toddler-age communication and language ratings (Infant/Toddler Checklist; Wetherby & Prizant, 2002), the participants were grouped into three groups with differential early profiles (for details, see Määttä et al., 2012): (1) children with delayed development of expressive skills (*ED*); (2) children with broad (expressive, social, and/or symbolic) communication and language delays (*BD*); and (3) children with typical development (i.e., with average or above average toddler-age communication and language development; *TD*). Several aspects of executive and regulative skills (attentional/executive functions, internalizing, externalizing, behavioral activity, social skills) were assessed using parental questionnaires at kindergarten-age.

The analyses indicated, first, that the two groups (i.e., BD and ED groups) with non-typical early communication development demonstrated poorer executive and regulative skills at kindergarten-age than children with typical early development. Second, children with broad early communication and language delays (BD) demonstrated compromised executive and regulatory skills mainly in the area of social skills and attentional/executive functions.

Third, children with early expressive delay (ED) were rated by parents as having more and a wider range of kindergarten-age executive and regulative difficulties than the children with broader early delays (BD). Fourth, concurrent language scores at kindergarten-age were associated with most of the executive and regulative scores, and most strongly with attentional/executive functions, after controlling for the effect of early language scores.

As expected, both groups with non-typical early communication development were rated as having lower social skills at kindergarten-age than children with typical development. This is in accordance with the often reported findings on difficulties in social functioning among children with language impairment (SLI; Botting & Conti-Ramsden, 2008; Fujiki et al., 2002; Hart et al., 2004; St Clair et al., 2011). The present study contributes to the field by using a longitudinal design and extending the observations of the association between language and social skills to a sample of children younger than those who have commonly been assessed.

Earlier literature on the links between early language and self-regulation contains mixed evidence. Some cross-sectional studies have shown associations between toddler-age language delays and concurrent behavior, emotional, and social development assessed mainly with parental behavior ratings (e.g., Carson et al., 1998; Irwin et al., 2002; Tervo, 2007), whereas some longitudinal studies using either parental ratings (Whitehouse et al., 2011) or neuropsychological tests (D'Odorico et al., 2007) have failed to find associations between the two domains. The present findings support the first line of evidence and suggest that delays in toddler-age communication and language development are associated not only with later language development, but also with later development of executive and regulative skills. Thus, detection of a subtle delay in early communication and language development warrants follow-up of also child's self-regulative development,.

Based on earlier research among children with SLI, we expected that especially children with broad early communication and language delays (BD) would show deficits in executive and regulative skills. In line with this expectation, we found that children in this subgroup manifested lower level of attentional/executive functions and social skills than children with typical development. However, they did not differ in the parental ratings of internalizing symptoms and behavioral activity (motor hyperactivity and impulsivity) and the slight trend for heightened externalizing problems was not statistically significant. This suggests that broad toddler-age language delays are not automatically associated with clear or wide-ranging later regulatory difficulties in all contexts (see also Hart et al., 2004), but the difficulties may be most evident in situations demanding control of attention, execution of planned activity, and compliance with social norms.

Somewhat surprisingly, the group with delayed early expressive skills (ED) was perceived by the parents as having the lowest kindergarten-age self-regulator skills. The overall pattern of parental ratings of the ED group indicated more problems than that of the typically developing children (see Figure 1). They had lower social skills, more internalizing symptoms and a trend for more externalizing symptoms. The children in the ED group demonstrated a higher level of internalizing problems in comparison to the group with broad delays (BD). Although low social skills and internalizing were expected among the children with early expressive skills delay (Irwin et al., 2002; Paul & Kellogg, 1997; Rescorla et al., 2007; Tervo, 2007; recently Valloton & Ayoub, 2011), their heightened problems in other skill areas were not anticipated. This result is even more interesting when considering our findings on a subsample of the same dataset indicating that parents perceived these children as having continued language difficulties at kindergarten-age (see also Määttä et al., 2012) although the children did not differ from the children with typical development in language

tests administered around the same age (see also Määttä, Laakso, Ahonen, Tolvanen, & Aro., in press).

Parental ratings of children's concurrent language skills were associated with most of the executive and regulative skills assessed simultaneously with the parental questionnaire. The subscale score of attentional/executive functions was most strongly associated with both early and concurrent language skills (highest Total R^2). In general, concurrent comprehension and communication were most often associated with executive and regulative skills whereas expressive skills were associated only with internalizing problems. This suggests that aspects of language are differentially connected to self-regulatory skills (c.f., Snowling et al. 2007; St Clair et al. 2011).

Although the mechanisms underlying the associations between language and regulative development were not directly addressed in the present study, our findings can be taken to suggest that the mechanisms may be dependent on the type of language delay. Parents perceived children with early *expressive* language delays as having fairly wide and persistent difficulties in both language and executive and regulatory skills still at kindergarten-age (see also Määttä et al., in press), although neuropsychological tests that were available for a subgroup of the children did not document a clear expressive language difficulty at the kindergarten-age. This suggests that parental perceptions of these children may continue to be negative and problem-focused or that children's problems manifest differentially in toddler- and in kindergarten-age. It is plausible that the mechanisms through which children's early expressive delays are associated with later self-regulative development are varied and may involve also other factors than child's language development. There may be antecedent or mediational factors such as parental concerns, and child-related temperamental factors, and factors affecting parental perceptions and interactional processes.

Early expressive delay is keenly observed by parents, and expressive vocabulary is also a central area of focus in the monitoring protocol of the toddler-age health clinics. Difficulties in this domain are salient and, thus, likely to cause parental worry and distress, which may affect parental observations and perceptions of the child and his/her abilities and behavior. Parental observations regarding their child's language and behavior may be intertwined especially in situations where there is a concern about the child's age-appropriate development. Previously, Chaffee, Cunningham, Secord-Gilbert, Elbart, and Richards (1991) reported that parental perceptions of stressful child behaviors accounted for a small but statistically significant proportion of the variance in their estimates of children's language skills.

Socio-emotional characteristics related to early expressive language delay may also contribute to parent-child interactional processes. Paul and Kellogg (1997) have suggested that the temperamental traits of children with early expressive difficulties, that is, shyness and withdrawal, may contribute to their problems through lesser motivation to communicate. Withdrawal prone behavior together with communicative difficulties may affect interactional processes between the child and the parent, for example, by modifying parenting practices and scaffolding and, thus, contribute to the child's future development of executive and language skills (e.g., Landry, Miller-Loncar, Smith, & Swank, 2002) and emotion regulation (Spinrad, Stifter, Donelan-McCall, & Turner, 2004). The children's risk that originates from temperamental and cognitive factors may be exacerbated by parent-child interaction processes (Carpenter & Drabick, 2011).

It is plausible that children with early expressive language delay also differ in affect regulation. For example, Kubicek and Emde (2012) found an association between early emotion expression and the emergence of expressive language: toddlers who learned verbal expressions early (early talkers) also expressed more positive emotions (e.g., joy and

pleasure) than those children whose acquisition of verbal expressions was slower (later talkers), whereas the latter expressed more negative emotions (e.g., fear and anger).

Both groups with non-typical early communication development (ED and BD groups) differed from the typically developing group in kindergarten-age social skills (i.e., cooperation, assertiveness, and responsibility) and showed low attentional/executive skills (i.e., directing, sustaining, and shifting attention, and planning). Interestingly, also concurrent language was most clearly associated with these two self-regulative skills. It can be speculated that there are differential underlying mechanisms behind these associations. For the ED group, self-regulatory skills in kindergarten-age may to a higher extent be moderated by parental perceptions and interactional processes, whereas for the BD group, regulative problems may be more directly linked to neurocognitive mechanisms and deficient concurrent language skills.

In the present study, a subsample of the children with broad language delay (BD) showed poorer performance in both language and memory tests at kindergarten-age than children with typical development suggesting that their problems may have somewhat larger scope (see also Määttä et al., in press). This finding is in accordance with the views claiming that among children with SLI more than one cognitive process is likely to be compromised (see Bishop, 2006). For example, associations between language skills and both working memory and inhibition have been shown (see e.g., Fuhs, 2011; Henry et al., 2012; Marton, Kelmenson, & Pinkhasova, 2007; Vance, 2008). However, the direction of causality is not clear, and there is also evidence showing that language functions (i.e., private or inner speech) may support cognition and behavior control (e.g., Lidstone, Meins, & Fernyhough, 2012). Thus, future research on language development should incorporate measures of inhibition, working memory, and control processes in order to gain a better understanding of the causal associations and their direction.

The present study contributes to the current literature by illuminating the complex relations between early communication and language development and later executive and regulative skills. However, several limitations need to be taken into account when interpreting the findings. First, since we used a population-based dataset, we were only able to identify a small number of children with difficulties in early development. This resulted in small group sizes especially in the groups identified as having compromised early communication and language profiles. Bigger subgroups would have allowed for more sophisticated analyses on the roles of concurrent vs. early language skills. Second, both toddler-age and kindergarten-age ratings were based on parental questionnaires, and kindergarten-age test data on language and cognitive skills were only available for a subset of the sample. More than one source of information (e.g., teacher reports or test based language assessment) would have provided a deeper understanding of the context specific nature of the mechanisms between language and self-regulatory skills. Furthermore, a larger data set and the availability of concurrent kindergarten-age test data on cognition and language skills (e.g., pragmatic and phonological skills) would have provided strength to the design. This would have enabled an analysis of the possible mediating effects of concurrent language on the relation between early language and later executive and regulative skills, and an investigation of the effects of persistent difficulties versus delay in early language development on the outcomes. Therefore, it must be noted that although the subgroups with different toddler-age communication profiles differed in ratings of self-regulation at kindergarten-age, no causal conclusions on predictive associations can be drawn on the basis of the present data. Furthermore, caution should be taken when comparing the present study to earlier studies as the literature contains different age ranges and varied aspects of language.

Developmental trajectories of children's language and regulation development are complex and intertwined. And cognitive skills, temperament, and interactional characteristics

are likely to have an effect on them. The present findings suggest that future research should explore the possibility of differential mechanisms between early language and subsequent self-regulative development depending on the type of early language delay. Deficits in underlying cognitive processes of such as attention and working memory may be involved either as causal or mediating factors among children with persistent language difficulties. However, early delay in expressive language may be rather associated with parental perceptions and responses to their child's early communication and language difficulties and the ensuing transactional processes moderating the associations between early language and later regulatory development. Since our data is very small, this conclusion is tentative and the proposed mechanism warrants further research.

Practical implications

Our observations of the differential paths of children belonging to the different early communication development groups are in line with those by St Clair and colleagues (2011) who concluded that different aspects of toddler-age language abilities exert different types and degrees of influence on later development. The findings provide support for the argument that the executive and regulatory development of children with language delays should be followed up in clinical practice. Children's difficulties in engaging in interactions with their parents, and parental responses to these difficulties, may disrupt the process of language learning (see Noel, Peterson, & Jesso, 2008). Therefore, attention should also be paid to the interactional process with the environment along the earlier identified risk factors (e.g., delay in comprehension, family history; see Paul & Roth, 2011) when planning interventions for children with early expressive delay and their families.

References

Aro, T., Eklund, K., Nurmi, J.-E., & Poikkeus A.-M. (2012). Early language and behavioral regulation skills as predictors of social outcomes. *Journal of Speech, Language, and Hearing Research, 2*, 395-408.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin, 121*, 65-94.

Barkley, R. A. (2012). *Executive functions. What they are, how they work, and why they evolved*. New York: Guilford Press.

Bishop, D. V. M. (2006). What causes specific language impairment in children? *Current Directions in Psychological Science, 15*, 217-221.

Blair, C. (2010). Stress and the development of self-regulation in context. *Child Development Perspectives, 4*, 181-188.

Blair, C. & Raver, C. C. (2012). Individual development and evolution: Experiential canalization of self-regulation. *Developmental Psychology, 48*, 647-657.

Botting, N. & Conti-Ramsden, G. (2008). The role of language, social cognition, and social skill in the functional social outcomes of young adolescents with and without a history of SLI. *British Journal of Developmental Psychology, 26*, 281-300.

Bronson, M. B. (2000). *Self-regulation in early childhood. Nature and nurture*. New York: Guilford Press.

Carpenter, J. & Drabick, D. (2011). Co-occurrence of linguistic and behavioral difficulties in early childhood: A developmental psychopathology perspective. *Early Child Development and Care, 181*, 1021-1045.

Carson, D. K., Klee, T., Perry, C. K., Muskina, G., & Donaghy, T. (1998). Comparisons of children with delayed and normal language at 24 months of age on measures of

behavioral difficulties, social and cognitive development. *Infant Mental Health Journal, 19*, 59-75.

Chaffee, C. A., Cunningham, C., Secord-Gilbert, M., Elbart, H., & Richards, J. (1991). The influence of parenting stress and child behavior problems on parental estimates of expressive and receptive language development. *Journal of Abnormal Child Psychology, 19*, 65-74.

Clegg, J., Hollis, C., Mawhood, L., & Rutter, M. (2005). Developmental language disorders-- a follow-up in later adult life. Cognitive, language and psychosocial outcomes. *Journal of Child Psychology and Psychiatry, 46*, 128-49.

Conti-Ramsden, G. (2013). Commentary: Increased risk of later emotional and behavioural problems in children with SLI – reflections on Yew and O'Kearney (2013). *Journal of Child Psychology and Psychiatry, 54,525-526.*

D'Odorico, L., Assanelli, A., Franco, F., & Jacob, V. (2007). A follow-up study on Italian late talkers: Development of language, short-term memory, phonological awareness, impulsiveness, and attention. *Applied Psycholinguistics, 28*, 157-169.

Durkin, K. & Conti-Ramsden, G. (2007). Language, social behavior, and the quality of friendship in adolescents with and without a history of specific language impairment. *Child Development, 78*, 1441-1457.

Feil, E., Small, J., Forness, S., Serna, L., Kaiser, A., Hancock, T., … Lopez, M. (2005). Using different measures, informants, and clinical cut-off points to estimate prevalence of emotional or behavioral disorders in preschoolers: Effects on age, gender, and ethnicity. *Behavioral Disorders, 4*, 375-391.

Field, A. (2009). *Discovering statistics using IBM SPSS statistics (3rd ed.)*. London: SAGE Publications.

Fuhs, M. W. (2011). Verbal ability and executive functioning development in preschoolers at head start. *Developmental Psychology, 47*(2), 404-416.

Fujiki, M., Brinton, B., & Clarke, D. (2002). Emotion regulation in children with specific language impairment. *Language, Speech, and Hearing Services in Schools, 33*, 102-111.

Fujiki, M., Spackman, M., Brinton, B., & Hall, A. (2004). The relationship of language and emotion regulation skills to reticence in children with language impairment. *Journal Speech, Language, and Hearing Research, 47*, 637-646.

Gresham, F. M. & Elliott, S. N. (1990). *The social skills rating system*. Circle Pines, MN: American Guidance Service.

Hart, K. I., Fujiki, M., Brinton, B., & Hart, C. (2004). The relationship between social behavior and severity of language impairment. *Journal of Speech, Language, and Hearing Research, 47*, 647-662.

Helland, T. & Asbjornsen, A. (2000). Executive functions in dyslexia. *Child Neuropsychology, 6*, 37-48.

Henry, L. A., Messer, D. J., & Nash, G. (2012). Executive functioning in children with specific language impairment. *Journal of Child Psychology and Psychiatry, 53*, 37-45.

Hughes, C., Ensor, R., Wilson, A., & Graham, A. (2010). Tracking executive function across the transition to school: A latent variable approach. *Developmental Neuropsychology, 35*, 20-36.

Irwin, J. R., Carter, A. S., & Briggs-Gowan, M. J. (2002). The social-emotional development of "late-talking" toddlers. *Journal of American Academy of Child and Adolescent Psychiatry, 41*, 1324-1332.

Kadesjö, B., Janols, L.-O., Korkman, M., Mickelsson, K., Strand, G., Trillingsgaard, A., & Gillberg, C. (2004). The FTF (Five to Fifteen): The development of a parent questionnaire for the assessment of ADHD and comorbid conditions. *European Child & Adolescent Psychiatry, 13 (Suppl. 3)*, 3-13.

Klenberg, L., Jämsä, S., Häyrinen, T., Lahti-Nuuttila, P., & Korkman, M. (2010). The Attention and Executive Function Rating Inventory (ATTEX): Psychometric properties and clinical utility in diagnosing ADHD. *Scandinavian Journal of Psychology, 5*, 439-448.

Kopp, C. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology, 18*, 199-214.

Korkman, M., Jaakkola, M., Ahlroth, A., Pesonen, A.-E., & Turunen, M.-M. (2004). Screening of developmental disorders in five-year-olds using the FTF (Five to Fifteen) questionnaire: A validation study. *European Child & Adolescent Psychiatry, 13 (Suppl. 3)*, 31-38.

Korkman, M., Kirk, U., & Kemp, S. L. (1997). *Lasten neuropsykologinen tutkimus (NEPSY: A developmental neuropsychological assessment*). Helsinki, Finland: Psykologien kustannus Oy.

Kubicek, L. F. & Emde, R. N. (2012). Emotional expression and language: A longitudinal study of typical developing earlier and later talkers from 15 to 30 months. *Infant Mental Health, 33*, 553-584.

Landry, S. H., Miller-Loncar, C. L., Smith, K. E., & Swank, P. R. (2002). The role of early parenting in children's development of executive processes. *Developmental Neuropsychology, 1*, 15-41.

Lidstone, J., Meins, E., & Fernyhough, C. (2012). Verbal mediation of cognition in children with specific language impairment. *Development and Psychopathology, 24*, 651-660.

Lindsay, G., Dockrell, J. E., & Srand, S. (2007). Longitudinal patterns of behavior problems in children with specific speech and language difficulties: Child and contextual factors. *British Journal of Educational Psychology, 77*, 811-828.

Määttä, S., Laakso, M.-L., Tolvanen, A., Ahonen, T., & Aro, T. (2012). Developmental trajectories of early communications skills. *Journal of Speech, Language, and Hearing Research, 55*, 1083-1096.

Määttä, S., Laakso, M.-L., Tolvanen, A., Ahonen, T., & Aro, T. (in press). Children with differing developmental trajectories of prelinguistic communication skills: Language and working memory at age 5. *Journal of Speech, Language, and Hearing Research.*

Marton, K. (2008). Visuo-spatial processing and executive functions in children with specific language impairment. *International Journal of Language and Communication Disorders*, 43, 181-200.

Marton, K., Kelmenson, L., & Pinkhasova, M. (2007). Inhibition control and working memory capacity in children with SLI. *Psychologia, 50*, 110-121.

Miller, M. R., Giesbrecht, G. F., Muller, U., McInerney, R. J., & Kerns, K. A. (2012). A latent variable approach to determining the structure of executive function in preschool children. *Journal of Cognition and Development, 3*, 395-423.

Muthén B. O. (2001). Latent variable mixture modelling. In G. A. Marcoulides & R. E. Schumacker (Eds.), *New developments and techniques in structural equation modelling*. Mahwah NJ: Lawrence Erlbaum Associates.

Muthén, L. & Muthén, B. O. (1998-2007). *Mplus users guide (5th ed.)*. Los Angeles, CA: Muthén & Muthén.

Muthén, B. & Shedden, K. (1999). Finite mixture modeling with mixture outcomes using the
EM algorithm. *Biometrics, 55*, 463-469.

Noel, M., Peterson, C., & Jesso, B. (2008). The relationship of parenting stress and child
temperament to language development among economically disadvantaged
preschoolers. *Journal of Child Language, 4*, 823-843.

Paul, R. & Kellogg, L. (1997). Temperament in late talkers. *Journal of Child Psychology and
Psychiatry, 38*, 803-811.

Paul, R. & Roth, F. P. (2011). Characterizing and predicting outcomes of communication
delays in infants and toddlers: Implications for clinical practice. *Language, Speech,
and Hearing Services in Schools, 42*, 331-340.

Petersen, I., T., Bates, J. E., D'Onofrio, B., M., Coyne, C., A., Landsford, J., E., Dogde, K.,
… & Van Hulle, C., A. (2013). Language ability predicts the development of
behavior problems in children. *Journal of Abnormal Psychology, 122*, 542-557.

Posner, M. I. & Rothbart, M. K.(2000). Developing mechanisms of self-regulation.
Development and Psychopathology, 12, 427-441.

Raffaelli, M., Crockett, L. J., & Shen, Y.-L. (2005). Developmental stability and change in
self-regulation from childhood to adolescence. *The Journal of Genetic Psychology,
166*, 54-75.

Reiter, A., Tucha, O., & Lange, K. W. (2005). Executive functions in children with dyslexia.
Dyslexia, 11, 116-131.

Rescorla, L., Ross, G., & McClure, S. (2007). Language delay and behavioral/emotional
problems in toddlers: Findings from two developmental clinics. *Journal of Speech,
Language, and Hearing Research, 50,* 1063-1078.

Schunk, D. H., & Zimmerman, B. J. (1997). Social origins of self-regulatory competence.
Educational Psychologist, 32, 195-208.

Snowling, M. J., Bishop, D. V. M., Stothard, S. E., Chipchase, B., & Kaplan, C. (2006). Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. *Journal of Child Psychology and Psychiatry, 47*, 759-765.

Snowling, M., Muter, V., & Carroll, J. (2007). Children at family risk of dyslexia: A follow-up in early adolescence. *Journal of Child Psychology and Psychiatry, 48*, 609-618.

Spinrad, T. L., Stifter, C. A., Donelan-McCall, N., & Turner, L. (2004). Mothers' regulation strategies in response to toddlers' affect: Links to later emotion self-regulation. *Social Development, 13*, 40-55.

St Clair, M., Pickles, A., Durkin, K., & Conti-Ramsden, G. (2011). A longitudinal study of behavioral, emotional and social difficulties in individuals with a history of specific language impairment (SLI). *Journal of Communication Disorders, 44*, 186-199.

Tervo, R. (2007). Language proficiency, development, and behavioral difficulties in toddlers. *Clinical Pediatrics, 6*, 530-539.

Vallotton, C. & Ayoub, C. (2011). Use your words: The role of language in the development of toddler's self-regulation. *Early Child Research Quarterly, 26,* 169-181.

Vance, M. (2008). Short-term memory in children with developmental language disorder. In C. F. Norbury, J. B. Tomblin, & D. Bishop (Eds.), *Understanding developmental language disorders: From theory to practice* (pp. 23-38). East Sussex: Psychology Press.

van Daal, J., Verhoeven, L., & van Balkom, H. (2007). Behavior problems in children with language impairment. *Child Psychology and Psychiatry, 48*, 1139-1147.

Vohs, K. D. & Ciarocco, N. J. (2004). Interpersonal functioning requires self-regulation. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation. Research, theory, and applications* (pp. 392-407). New York: Guilford Press.

Vygotsky, L. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Wechsler, D. (1989). *Wechsler Preschool and Primary Scale of Intelligence – Revised*. San

Antonio, TX: The Psychological Corporation.

Westby, C. E. & Cutler, S. K. (1994). Language and ADHD: Understanding the bases and

treatment of self-regulatory deficits. *Topics in Language Disorders, 4*, 58-76.

Wetherby, A. M. & Prizant, B. M. (2002). *Communication and symbolic behavior scales:*

Developmental profile (1st normed ed.). Baltimore: Paul H. Brookes Publishing.

Whitehouse, A. J. O., Robinson, M., & Zubrick, S. R. (2011). Late talking and the risk for

psychosocial problems during childhood and adolescence. *Pediatrics, 2*, 324-332.

Wolfe, C. D. & Bell, M. A. (2007). Sources of variability in working memory in early

childhood: A consideration of age, temperament, language, and brain electrical

activity. *Cognitive Development, 4*, 431-455.

Yew, S. G. K. & O'Kearney, R. (2013). Emotional and behavioral outcomes later in

childhood and adolescence for children with specific language impairments: Meta-

analyses of controlled prospective studies. *Journal of Child Psychology and*

Psychiatry, 54, 516-524.

Table 1

Scales Used to Assess Executive and Regulative Skills

Executive and regulative problem	Source and items	Number of items and alphas	Example of the items
Attentional /executive functions	*ATTEX scales*: Directing attention (5 items) Sustaining attention (5 items) Shifting attention (3 items) Planning (3 items)	16 items, α = .81	*ATTEX Directing:* Attends to unessential details; Is absentminded *ATTEX Sustaining:* Has difficulties completing tasks; Is able to keep working only for a short while at a time *ATTEX Shifting:* Has difficulties noting two things at the same time; Has difficulties changing from one type of activity to another *ATTEX Planning:* Starts working on tasks without planning; Has difficulties evaluating how much time tasks require
Regulation of emotions	*SSRS scales*: Internalizing (4 items) Externalizing (6 items)	*Internalizing:* 4 items, α = .69 *Externalizing:* 4 items, α = .66	*Internalizing:* Appears lonely; Shows anxiety about being with a group of children *Externalizing:* Has temper tantrums; Argues with others
Regulation of behavioral activity	*ATTEX scales*: Impulsivity (9 items) Motor restlessness (7 items) *FTF scales:* Hyperactivity/Impulsivity (9 items)	The *regulation of emotions* scale consisted of …"	*ATTEX Impulsivity:* Is clearly impatient; Is unable to wait for turns *ATTEX Motor restlessness:* Constantly needs manual activities *FTF Impulsivity:* Talks constantly; Has difficulties to play quietly and calmly
Social skills	*SSRS scales*: Cooperation (10 items) Assertiveness (10 items) Responsibility (10 items)	10 items, α = .71	*Cooperation:* Follows your orders; Participates in games or group activities *Assertiveness:* Makes friends easily; Appropriately questions rules that may be unfair *Responsibility:* Requests permission before leaving the house

Table 2

Means and Standard Deviations of the Broad Delay (BD), Expressive Delay (ED), and Typical Early Language Development (TD) Subgroups in Language and Cognitive Measures.

Measure	BD			ED			TD			Kruskal-Wallis
	Mean	SD	n	Mean	SD	n	Mean	SD	n	p
FTF Language scale, raw score	.37	.35	12	.41	.32	45	.17	.26	128	.000 [a]
NEPSY-II Sentence Repetition, scale score	8.21	3.86	29	9.33	3.27	6	11.11	2.71	55	.004 [b]
NEPSY-II, Nonsense Word Repet., scale score	9.18	3.24	28	10.80	3.70	5	11.34	2.60	55	.011 [b]
WPPSI-R, Similarities, scale score	10.97	3.19	29	13.00	3.32	5	12.59	2.56	54	.040 [b]
WPPSI, Block Design, scale score	10.68	3.19	28	12.57	2.35	5	11.57	2.87	56	ns.
WPPSI, Digit Span, scale score	9.18	2.89	28	11.17	3.06	6	11.37	2.74	56	.003 [b]

[a] Both BD and ED groups differed ($p <= .01$) from TD.
[b] BD group differed ($p <= .05$) from TD group.

Table 3

Correlations between the Executive and Regulative Skills Scores

	Attention/ executive	Internalizing	Externalizing	Social skills
Internalizing	.357**			
Externalizing	.202*	.232**		
Behavioral activity	.539**	.130	.371**	
Social skills	.474**	.280**	.331**	.359**

*Correlation is significant at the .05 level (2-tailed).

**Correlation is significant at the .01 level (2-tailed).

Table 4

Means and Standard Deviations of Executive and Regulative Skills Scores by Gender Separately for the Broad Delay (BD), Expressive Delay (ED), and Typical Early Language Development (TD) Subgroups

Executive and Regulative Skills		BD 18 boys 27 girls		ED 5 boys 7 girls		TD 63 boys 65 girls	
		Mean	SD	Mean	SD	Mean	SD
Attentional/ executive functions	Girls	-.20	1.32	-.50	1.44	.27	.60
	Boys	-.38	.75	-.26	.82	-.02	.67
	Total	-.31	1.00	-.40	1.18	.13	.65
Internalizing	Girls	-.19	.95	-.30	.92	.31	.93
	Boys	.20	.73	-1.14	1.50	.20	.72
	Total	.04	.84	-.65	1.20	.15	.93
Externalizing	Girls	-.29	1.09	-.70	1.34	.17	.67
	Boys	-.14	1.04	-.41	1.11	-.02	.89
	Total	-.20	1.05	-.58	1.20	.06	.85
Behavioral activity	Girls	.14	.71	-1.05	1.53	.11	.84
	Boys	.03	.85	.01	.75	-.08	.90
	Total	.07	.79	-.61	1.33	.02	.88
Social skills	Girls	-.20	1.00	-.59	1.08	.23	.78
	Boys	-.28	.71	-.43	.21	.01	.70
	Total	-.25	.83	-.52	.81	.12	.75

Table 5

Summary of Hierarchical Regression Analysis for Executive and Regulative Skills Scores

| Executive and Regulative Skills	Variables in the equation	B	SE B	Change R^2	Sig.	Total R^2
Attentional/ executive functions	*1.step ITC scores:* Symbolic composite	.061	.033	.086	.000	
	2. step FTF scores: Comprehension	-1.052	.183	.263	.000	
	Communication	-.661	.135	.076	.000	
						.425
Internalizing	*1.step ITC scores:* Speech composite	.050	.041	.024	.035	
	Social composite	-.074	.028	.030	.017	
	2. step FTF scores: Comprehension	-.795	.224	.102	.000	
	Expressive language	-.494	.224	.022	.029	
						.179
Externalizing	*1.step ITC scores:* Speech composite	.137	.044	.051	.002	
	2. step FTF scores: -			-	-	
						.051
Behavioral activity	*1.step ITC scores:* -			-	-	
	2. step FTF scores: Communication	-.410	.181	.076	.000	
	Comprehension	-.546	.248	.026	.029	
						.100
Social skills	*1.step ITC scores:* Speech composite	.083	.034	.097	.000	
	2. step FTF scores: Comprehension	-.821	.208	.126	.000	
	Communication	-.315	.154	.018	.042	
						.241
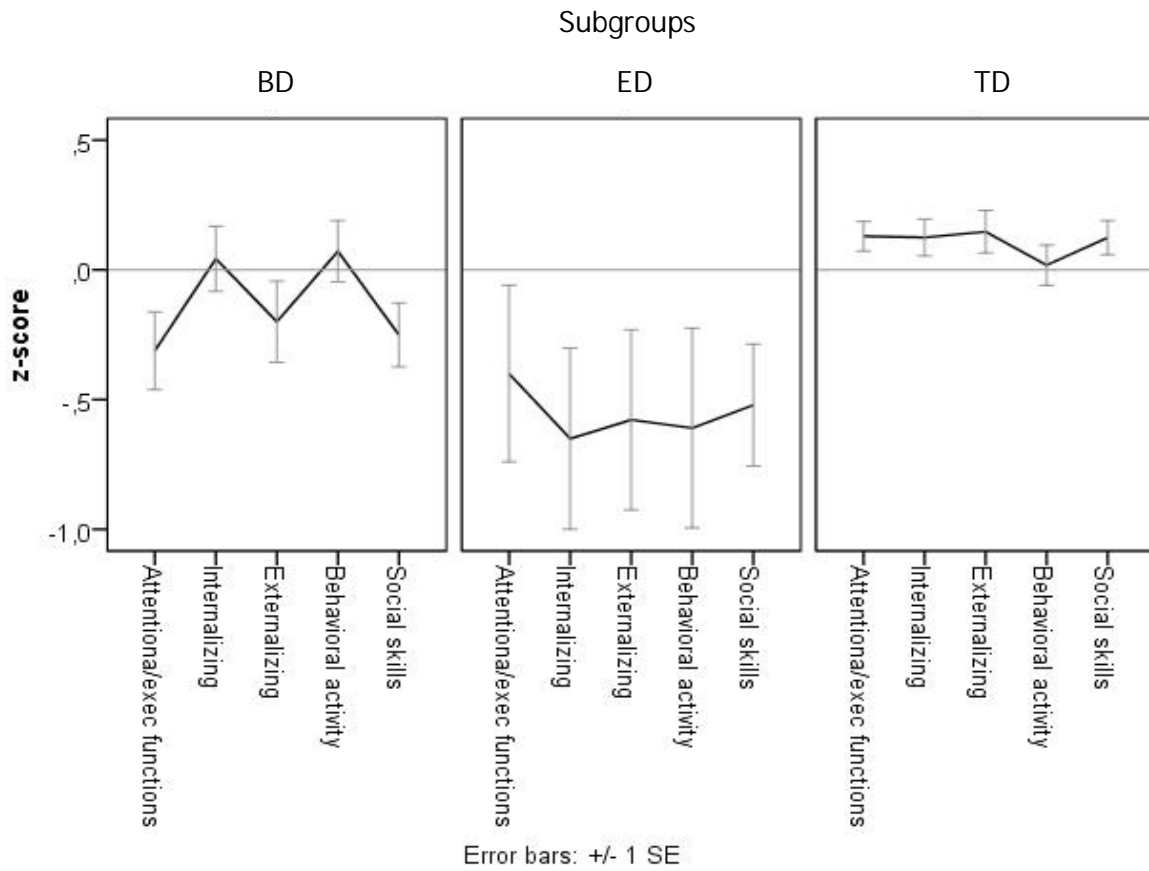
Figure 1. Executive and Regulative Skills of the Early Language and Communication Subgroups. *BD = Broad Delay; ED = Expressive Delay (ED), TD = Typical Early Language Development (TD)*