# Original Papers

*Anna Orylska*[*]
*Aneta Brzezicka*[*]
*Ewa Racicka-Pawlukiewicz*[**]
*Rafał Albinski*[*]
*Grzegorz Sedek*[*]

# Parent-Teacher Concordance in Rating Preschooler Difficulties in Behavioural and Cognitive Functioning and Their Dyadic Predicting of Fluid Intelligence

***Abstract***: **Objective**: *Present research examined children's behavioural and cognitive functioning by using data from a screening study based on reports given by parents and teachers, and investigated the strongest predictors of children's fluid intelligence.*
**Method**: *Scales: Conners Early Childhood Behaviour Scale (CEC BEH [S]) and Behaviour Rating Inventory of Executive Function-Preschool (BRIEF-P) were filled out by parents and teachers of preschool children. Raven's Coloured Progressive Matrices (CPM) was used to measure fluid intelligence among preschool children.*
**Results**: *Parent-teacher concordance was low to moderate. Working memory in BRIEF-P estimated by teachers and parents mediated the relationship between inattention/hyperactivity in CEC BEH [S] and fluid intelligence among preschoolers. The difficulties with working memory assessed by teachers and parents were significant predictors of Raven scores; however, predictions based on teachers' assessments were stronger.*
**Conclusion**: *Clinicians should collect reports from various observers in order to implement prevention programs and optimize clinical diagnoses for children. Information from both parents and teachers give significant and complementary contribution to understanding difficulties with cognitive and behavioural functioning of preschoolers.*

***Key words***: *behavioural and cognitive functioning of preschoolers, parent-teacher agreement, intelligence in preschoolers*

## Introduction

Accurate evaluation of preschoolers' development is important for their future social and academic functioning. Early and accurate assessments facilitate effective interventions and prevention by applying deficit management programs appropriate for a particular child (DuPaul & Kern, 2011; Holmes et al., 2014). Questionnaire rating performed by independent persons familiar with the child, usually parents and teachers, is the most common screening method used to evaluate problematic childhood behaviour and functioning (Clinical Practice Guideline, 2011; Deb, Dhaliwal, & Roy, 2008; Holmes et al., 2014; Korsch & Peterman, 2014). Hence, there is a need for further studies estimating parent-teacher concordance or discrepancy of reports about preschoolers' behaviours. These may help identify potential issues and introduce interventions and preventive programs, or justify the need for further diagnostic procedures.

[*]  **SWPS University of Social Sciences and Humanities, Warsaw, Poland**
[**] **Medical University of Warsaw, Department of Child Psychiatry, Poland**

*Author Note*

Anna Orylska, Aneta Brzezicka, Rafał Albinski and Grzegorz Sedek, Department of Psychology, SWPS University of Social Sciences and Humanities, Warsaw, Poland; Ewa Racicka-Pawlukiewicz, Department of Child Psychiatry, Medical University of Warsaw, Poland.

Correspondence concerning this article should be addressed to Anna Orylska, Department of Psychology, SWPS University, Chodakowska 19/31, 03-815 Warsaw, Poland. E-mail: aorylska@gmail.com

There are a number of studies on teacher-parent comparison in reports estimating child behaviour. Teacher-parent concordance was estimated in reference to questionnaire subscales (Grietens et al., 2004) but also in reference to specific items (Cai, Kaiser & Hancock, 2004). In both types of studies, teacher-parent agreement was low to moderate (Achenbach, McConaughy & Howell, 1987; Duhig, Renk, Epstein & Phares, 2000; Grietens et al., 2004; Mitsis, McKay, Schulz, Newcom & Halperin, 2000; Narad et al., 2015; Spiker, Kraemer, Constantine & Bryant, 1992; Stanger & Lewis, 1993). Compared to teachers, parents noticed more behaviour issues of their children (Biederman, Faraone, Milberger, & Doyle, 1992; Biederman, Keenan & Earaone, 1990; Verhulst & Akkerhuis, 1989; Grietens et al., 2004).

Concordance between reports given by independent observers is stronger for assessments of younger children and weaker for assessments of older children (Achenbach et al., 1987; Grietens et al., 2004). Factors influencing discrepancies were also analysed, e.g., gender (Briggs-Gowan, Carter, & Schwab-Stone, 1996; Touliatos & Lindholm, 1981; Verhulst & Akkerhuis, 1989), age (Narad et al., 2015; Verhulst & Akkerhuis, 1989), mental health (Chilcoat & Breslau, 1997; Egeland, Kalkoske, Gottesman & Erickson, 1990; Epkins, 1996; Kolko & Kazdin, 1993; Narad et al., 2015; Querido, Eyberg & Boggs, 2001; Richters, 1992; Sointu, Savolainen, Lappalainen, & Epstein, 2012; Treutler & Epkins; 2003 Youngstrom, Loeber & Stouthamer-Loeber, 2000), and socioeconomic status (Cai et al., 2004).

It must be noted that published studies yielded incongruent findings about the role of demographic factors (e.g., age or gender). However, research shows that parents and teachers identify divergent behavioural problems, and this influences the classification of the child's behaviour to different subgroups or subtypes (Achenbach, 1995). According to researchers and clinicians, this low to moderate concordance between observers suggests that their reports are complementary and, taken together, may help understand the child's functioning in different environments (Stanger & Lewis, 1993). Each observer provides unique perspective and may influence the final assessment or clinical diagnosis (Merrell, 1999).

The aim of the present study was to gain insight into children's behavioural and cognitive functioning by using data from a screening study with reports given by parents and teachers and to identify the strongest predictors of the children's fluid intelligence. We formulated two research problems. Firstly, we wanted to analyse similarities and differences of the teacher and parent reports about children's cognitive and behavioural functioning. Secondly, we wanted to test if it is possible to predict fluid intelligence based on questionnaires filled out by observers. If so, we wanted to identify which variables would allow for such predictions and if there is a difference in accuracy of those predictions when we compare data from teachers and parents. More specifically, we wanted to replicate and extend the recent findings (Rahbari & Vaillancourt, 2015) that especially working memory subscales (i.e.,

working memory functions of preschool children assessed independently by parents and teachers) are the best predictors of fluid intelligence among those preschoolers. Furthermore, we intended to examine the validity of mediational relationships, namely that the working memory functions mediate the relationship between some problematic behaviours of children (i.e., inattention and hyperactivity) and fluid intelligence.

To address these research problems, we have used the following questionnaires: an experimental version of Conners Early Childhood Behaviour Scale (CEC BEH [S]) and the experimental version of Behaviour Rating Inventory of Executive Function-Preschool (BRIEF-P) that were adapted for the study. CEC BEH [S] is used for the early identification and group screening of ADHD, and for the research studies of issues in behavioural, social, and emotional areas (Conners, 2009), whereas BRIEF-P is used to assess children's everyday functioning in home and preschool settings and through that assess cognitive processes and executive functions (Gioia, Espy, Isquith, 2003; Isquith, Gioia & Espy, 2004; Sherman & Brooks, 2010). Behavioural rating scales (both BRIEF and Conners' rating scales) are common instruments used in evaluations of ADHD and executive dysfunctions (Rohrer-Baumgartner et al., 2014; Deb et al., 2008; Holmes et al., 2014; Naglieri, Goldstein, Delauder, & Schwebach, 2005; Skogan et al., 2015, Sullivan & Riccio, 2007).

Executive functions (EF) are defined as a broad set of cognitive functions such as inhibition, planning, working memory, abstract thinking, selective attention, and cognitive flexibility or shifting (Barkley, 2001; Isquith et al., 2004; for a review of EF in preschoolers, see: Garon, Bryson, & Smith, 2008). As EF are defined as a rather broad set of functions one can expect that fluid intelligence will not be similarly related to all those functions. Indeed, researchers suggest that functions of working memory are more associated with fluid intelligence scores than other EF (Alloway, Elliott, & Place, 2010; Friedman et al., 2006; Salthouse, Atkinson, & Berish, 2003; Rahbari & Vaillancourt, 2015). For example, Alloway and Alloway (2010), Friedman and colleagues (2006), Oberauer, Süß, Wilhelm, and Wittman (2008), as well as Rahbari and Vaillancourt (2015) showed that measures of working memory were highly correlated with the intelligence measures. It seems that even though certain components of EFs may have differential links with intelligence, relations between working memory and intelligence are the most pronounced.

In order to examine such relations in children it is important to identify EFs tasks that are sensitive to individual (e.g., language ability, activity levels) and age variations across a wide preschool-age range. Some researchers assess children's EF skills using experimental tests (e.g., Ardila, Pineda, & Rosselli, 2000; Arffa, 2007; Arffa, Lovell, Podell, & Goldberg, 1998; Friedman et al., 2006); however, such approach has been criticized as being too narrow and failing to accurately capture children's "real-surroundings" functioning (Bodnar, Prahme, Cutting, Denckla, & Mahone, 2007). Recently, increased number

of researchers applied BRIEF-P questionnaire (Gioia et al., 2003) as a measure of EFs among preschoolers in the context of everyday environments together with experimental tests of working memory and other executive functions (Holmes et al., 2014; Mahone & Hoffman, 2007; Skogan et al., 2015).

Regarding the interrelations between BRIEF-P, Conners' rating scales, and intelligence, the researchers identified some stable patterns. Rahbari and Vaillancourt (2015) demonstrated that among all executive functions diagnosed by BRIEF-P, working memory subscale (assessed separately by teachers and parents of each child) had the strongest correlations with the verbal and performance subtests from Wechsler Preschool and Primary Scale of Intelligence (Wechsler, 2002). Among the subscales of Conners' rating scale, the inattention/hyperactivity subscale showed the most systematic correlations with intelligence tests (Conners, 2009; Deb et al., 2008; Naglieri et al., 2005).

To sum up, in the present study we have not only compared teacher-parent estimates of the child's functioning, but we also supplement these estimates with psychological measures of fluid intelligence in order to increase the value of the diagnosis and to pair the assessments done by parents and teachers with objective measures of fluid intelligence (Raven's CPM). The questionnaires we used (i.e., CEC BEH [S] and BRIEF-P) allow not only to describe the child's behaviours but also to estimate cognitive functioning (as viewed by parents and teachers). We aimed: (1) to grasp characteristics and concordance of estimations conducted by significant adults from the child's various environments, and (2) to yield the empirical evidence that relationships between some problematic forms of behaviour (especially inattention and hyperactivity diagnosed by CEC BEH [S]) and fluid intelligence of preschool children (Raven, Court, & Raven, 1986), are mediated by dysfunctions of working memory (diagnosed by BRIEF-P).

Previous research on the relationships between BRIEF-P, CEC BEH [S], and intelligence applied simple correlational or regression analyses. However, in our statistical analyses we will apply more advanced path dyadic models (Peugh, DiLillo, & Panuzio, 2013) that are more appropriate to integrate mixed-dyadic data (i.e., teachers' and parents' evaluations of the same children).

## Method

### Participants

Children, their parents and teachers from eight randomly chosen preschools located in the Warsaw area in Poland were recruited to participate in the study. Figure 1 presents the chart with flow of participants, measures and analysis. The statistical analyses were based on measurement files from 143 preschoolers who had complete data sets from parents, teachers and performed Raven's CPM.

Parents of the children were informed about the goals of the study and provided their written consent. There was one inclusion criteria for children: participants were required to obtain raw score $\geq 85$ in Raven's CPM test (Raven et al., 1986). All examined 179 preschoolers met this criterion, $M = 20.93$, $SD = 4.78$. The sample consisted of 80 boys and 99 girls with the mean age (M = 5.05 yrs., SD = .40). Age of preschoolers' mothers in years: M = 35.03, SD = 4.25. Age of preschoolers' fathers in years: M = 37.78, SD = 5.14. Number of years of formal education of preschoolers' mothers: M = 15.27, SD = 2.68. Number of years of formal education of preschoolers' fathers: M = 14.51, SD = 2.73.

**Figure 1. Flow of participants, measure and analysis**
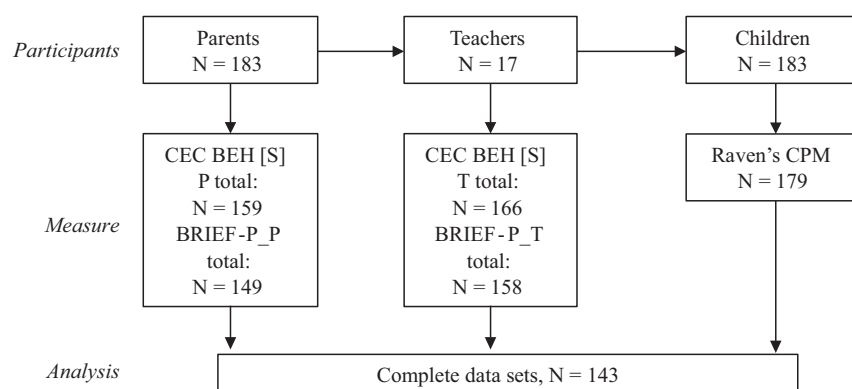


CEC BEH [S] P = Conner's Early Childhood Behaviour Scale – Parents, CEC BEH [S] T = Conner's Early Childhood Behaviour Scale – Teachers;
BRIEF-P_P = Behaviour Rating Inventory of Executive Function-Preschool – Parents, BRIEF-P_T = Behaviour Rating Inventory of Executive Function-Preschool – Teachers;
Raven's CPM = Raven's Coloured Progressive Matrices

## Measures

Polish versions of CEC BEH(S) and BRIEF-P were developed as part of the project (experimental versions suitable for use in research). Original questionnaire contents were translated into Polish independently by two persons (both fluent in English and without experience working with children). The final version was based on the two translations and evaluated by a group of experts (child psychiatrists and psychologists specializing in ADHD diagnosis) who were unfamiliar with the original version. A certified translator did a back-translation. Questionnaire items were accepted as final when the original and back-translated versions were identical or similar (the differences were deemed insignificant by a skilled translator).

CEC BEH [S] is used to assess a wide range of behavioural, emotional, and social concerns in children aged 2 to 6 (versions for parents and caregivers) in the following dimensions: inattention/hyperactivity, defiant/aggressive behaviour, social functioning/atypical behaviour, anxiety, mood and affect, and physical symptoms. CEC BEH [S] P for the parents consists of 47 questions and CEC BEH [S] T for the teachers of 46 questions. Answers are given on a 4-point Likert scale (0 = Not true at all [Never, Seldom]; 3 = Very much true [Very often, very frequently]). Two additional open questions were included. The inattention/hyperactivity component measures difficulty with control of attention and/or behaviour. The following are levels of inattention/hyperactivity component.May have poor concentration and/or be easily distracted. May have high activity levels and/or impulsivity (e.g., "Loses interest quickly", "Restless or overactive"). Defiant/aggressive behaviour component measures problem with controlling temper. May have problems with physical and/or verbal aggression (e.g., "Is defiant.", "Picks on other children."). The social functioning/atypical behaviour component measures difficulty with friendships and social cues. This includes the following: May be odd and unusual also appear disinterested in social interactions (e.g., "Has trouble keeping friends"). The anxiety component measures anxious, including emotional or physical symptoms. This includes the following: May be fearful, clingy or easily frightened (e.g., "Is afraid to be alone.", "Worries."). The mood and affect component measures mood problems and may include irritability, sadness, negativity, and anhedonia (e.g. "Does not enjoy things.", "Cries often and easily."). The physical symptoms component measures physical symptoms that may have medical/emotional roots (e.g., "Seems tried during the day.", "Complains about headaches."), (Conners, 2009).

BRIEF-P is used to estimate preschoolers' (2–5 years old) executive function in five dimensions: inhibit, shift, emotional control, working memory, plan/organize. BRIEF-P consists of 63 items, and answers are given on a 3-point Likert scale (0-never to 2-often). The teacher and parent versions are identical and rate a child's executive functions within the context of his or her everyday home and preschool setting. (Isquith, Gioia & Espy, 2004).

The inhibit component measures the child's inhibitory control and ability to stop his or her behaviour at the appropriate time (e.g., "Is impulsive", "Talk or play too loudly."). The shift component measures a child's ability to move freely from one situation or aspect of a problem to another (e.g., "Becomes upset with new situations", "Is bothered by loud noises, bright lights, or certain smells."). The emotional control component measures a child's ability to modulate emotional responses (e.g., "Overreacts to small problems"; "Has outbursts for little reason."). The working memory component measures the child's capacity to hold information in their mind to complete a task (e.g., "Needs help from adult to stay on task"; "Has a short attention span."). The plan/organize component measures the child's ability to manage current and future task demands within the situation context (e.g., "Does not complete tasks even after given directions"; "Has trouble following established routines for sleeping, eating, or plan activities.") (Gioia, 2003).

Raven's CPM is a psychological, nonverbal test to measure fluid intelligence for children aged 4–10, and it consists of 36 tasks in three sets (A, AB, B; 12 tasks for each set). Set A checks the child's ability to complete the continuing patterns. Set AB checks the child's ability to perceive the separate forms as one gestalt on the basis of spatial relations. Set B checks the child's ability in abstract thinking. The tasks are presented in the form of incomplete patterns (matrices), printed in colour, and the child needs to choose the missing element from a given set of possible answers. There is no time limit, but the test usually takes 15 minutes (Raven, Court & Raven, 1986; Polish adaptation: Szustrowa & Jaworowska, 2003).

## Procedure

In order to inform parents about the study series of meetings were organized by researchers and teachers in each of the randomly chosen preschools. In the next step teachers were asked to pass on to the parents a set of documents and questionnaires (consisting of the invitation letter, information sheets, CEC BEH [S] and BRIEF-P questionnaires, written consent, a return envelope, and contact information). Parents completed CEC BEH [S] P and BRIEF-P questionnaires, signed the written consent form, and returned the documents in envelopes to teachers. Afterwards teachers filled out CEC BEH [S] T and BRIEF-P for each participating child in their classroom. Teachers were remunerated 10 PLN (ca. $3) for each complete set of questionnaires returned to the researchers. In the last step the children were individually tested using Raven's CPM at the preschools (permission was obtained from parents beforehand).

## Results

### Reliability of CEC BEH [S] and BRIEF-P

Cronbach's Alpha was computed to verify reliability of CEC BEH [S] and BRIEF-P subscales (separate coefficient for each subscale, Table 1 and 2). All CEC BEH [S] subscales reached reliability. All BRIEF-P subscales reached sufficient reliability with coefficients over 0.8.

## Parents and teachers assessments of preschoolers behaviour

In order to examine how parents and teachers assess children's behaviour, we conducted two types of analysis for each questionnaire: (1) analysis of variance to see if there are any differences between those two groups; (2) correlation analysis for each subscale in order to test the degree of congruency in preschoolers behaviour as evaluated by parents and teachers.

## Conner's Early Childhood Behaviour Scale

As a first step of analysis of the CEC BEH [S] data, a 2 (source of assessment: parents vs. teachers) × 6 (subscales: Inattention/hyperactivity, Defiant/aggressive behaviours, Social functioning/atypical behaviours, Anxiety, Mood and affect, Physical symptoms) repeated measures ANOVA was conducted on CEC BEH [S] results. Greenhouse–Geisser correction for violation of the sphericity assumption was used when applicable (Greenhouse & Geisser, 1959). All effects were statistically significant: main effect of source of assessment, $F(1,142) = 20.75$; $p < .001$; $\eta^2_p = .128$; main effect of subscales, $F(5,710) = 55.23$; $p < .001$; $\eta^2_p = .280$; and interaction effect, $F(5,710) = 25.94$; $p < 0.001$; $\eta^2_p = .154$. The main effect of source assessment shows that higher ratings were given by parents ($M = 4.31$) than teachers ($M = 3.21$). The main effect of subscales shows significant differences (here and in the next comparisons, Student-Newman-Keuls post-hoc tests were applied) between most of the scales, except for defiant/ aggressive behaviour and social functioning scales ($p = .052$) and social functioning and mood scales ($p = 1$). These main effect were qualified by the interaction effect showing significant differences between parent-teacher assessments for all scales except inattention/hyperactivity scale (see Figure 2). Importantly, the anxiety subscale was the only one in which teachers' ratings ($M = 3.47$) were higher than parents' ratings ($M = 2.70$).

To assess the degree of congruency in preschoolers' behaviour evaluation by parents and teachers, correlation analysis for each subscale of CEC BEH [S] was conducted. Detailed results are presented in Table 3. The highest congruency was observed for the inattention/hyperactivity scale. For two scales (Anxiety and Physical symptoms), correlation coefficients were low and not significant.

## Behaviour Rating Inventory of Executive Function-Preschool

First, a 2 (source of assessment: parents vs. teachers) x 5 (subscales: Inhibition, Switching, Emotional control, Working memory, Planning) repeated measures ANOVA was conducted on results obtained using BRIEF questionnaire. Greenhouse–Geisser correction for violation of the sphericity assumption was used when applicable (Greenhouse & Geisser, 1959). Only the main effect of subscales was statistically significant, $F(4,516) = 107.02$; $p < .001$, $\eta^2_p = .694$, showing differences between all scales except inhibition and working memory scales ($p = .72$). The interaction effect was not significant, although a strong tendency was observed: $F(4,516) = 2.59$; $p = .055$, $\eta^2_p = .059$. Post hoc comparisons showed that teachers ($M = 5.66$) and parents ($M = 6.73$) differ in their assessment of children's executive functioning emotional control scale ($p < .05$; see Figure 3).

**Table 1.** Cronbach's Alpha reliability coefficient for CEC BEH [S] subscales for each group of observers

| Subscale | Teachers | Parent |
|---|---|---|
| Inattention/hyperactivity | .91 | .86 |
| Defiant/aggressive behaviours | .92 | .80 |
| Social functioning/atypical behaviours | .83 | .59 |
| Anxiety | .71 | .56 |
| Mood and affect | .76 | .65 |
| Physical symptoms | .75 | .68 |

**Table 2.** Cronbach's Alpha reliability coefficient for BRIEF-P subscales for each group of observers

| Subscale | Teacher | Parent |
|---|---|---|
| Inhibition | .96 | .92 |
| Shifting | .92 | .81 |
| Emotional control | .94 | .85 |
| Working memory | .95 | .89 |
| Planning | .94 | .82 |

**Figure 2. Differences in children's behaviour assessment between parents and teachers on different subscales of Conner's Early Childhood Behaviour Scale – CEC BEH [S]**
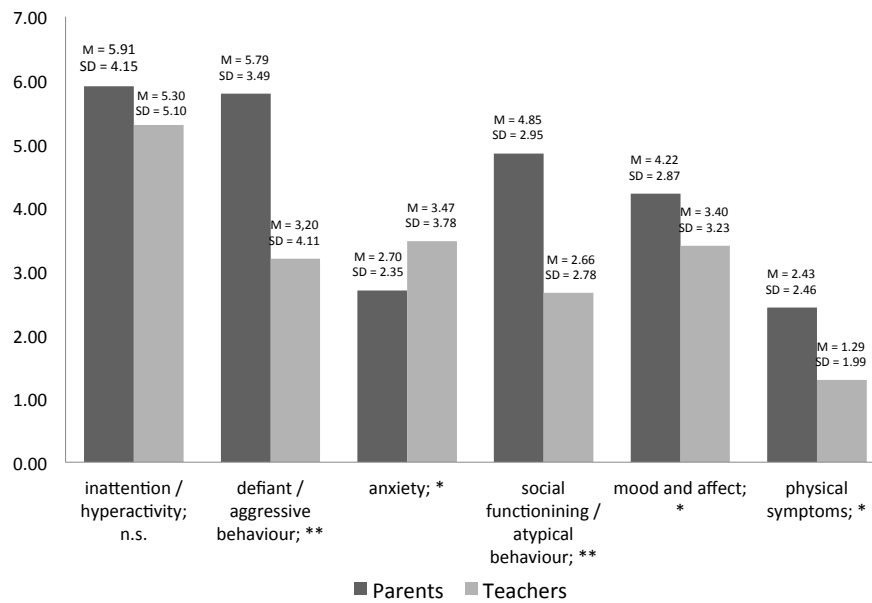


* $p < .01$, ** $p < .001$

**Figure 3. Differences in children's behaviour assessment between parents and teachers on different subscales of Behaviour Rating Inventory of Executive Function-Preschool – BRIEF-P**
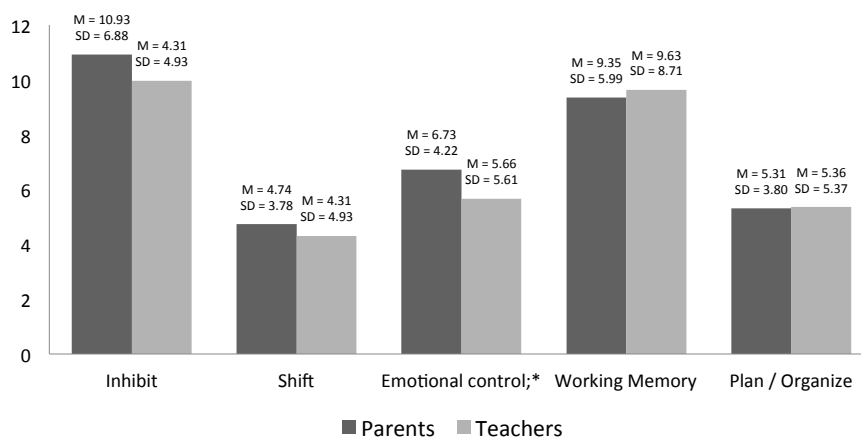


* $p < .05$

**Table 3. Correlation coefficients between assessments of parents and teachers for each subscale of CEC BEH [S].**

| Scale | Correlation coefficients |
|---|---|
| Inattention/hyperactivity | .44** |
| Defiant/aggressive behaviours | .25** |
| Social functioning/atypical behaviours | .38** |
| Anxiety | .14 |
| Mood and affect | .22** |
| Physical symptoms | .09 |

** $p < .001$

To assess the degree of congruency in preschoolers' executive functions evaluation by parents and teachers, correlation analysis for each subscale of BRIEF-P was conducted, similarly to analysis for CEC BEH [S] subscales. Detailed results are presented in Table 4. Statistically significant relations between parents' and teachers' assessments were obtained for all subscales, with strongest correlations observed for the inhibition scale.

### Analyzing mixed-dyadic data using path analyses

Mixed-dyadic data (teachers vs. parents evaluations of the same children, as in case of current research) demand additional statistical analyses that appropriately model the variation within dyads and between dyads (Gonzales & Griffin, 2012; Kenny, Kashy, & Cook, 2006; Peugh, DiLillo, & Panuzio, 2013). These dyads data are distinguishable (distinct evaluations of parents and teachers) in contrast to twin studies. In this section, we perform two path analyses within the methodology of structural equation models to do the following: a) clarify relationships between full versions of questionnaires, namely, Conner's Early Childhood Behaviour Scale (CEC BEH [S]) and Behaviour Rating Inventory of Executive Function-Preschool (BRIEF-P) based on data from both parents and teachers assessing the same children; and b) to identify the direct and indirect (mediated) relationships between CEC BEH [I/H] subscales of inattention/hyperactivity and working memory subscales of BRIEF-P_WM (again, assessment of both parents and teachers) as predictors of fluid intelligence of preschoolers (measured by Raven's CMT).

### Distinguishable dyad teacher-parent interdependence analysis model

In this model (see Fig. 4), we observed the medium size correlation (.27) between CEC BEH [S] and BRIEF-P scales filled out by parents and teachers. The residual errors (e1 and e2) were not significantly correlated; thus, this model was not saturated (possesses 1 degrees of freedom), and hence it was possible to estimate the goodness of fit of this path analysis. These estimations were very good: $\chi^2 (1) = .37$; $p = .54$; Comparative Fit Index (CFI) = 1.00; Root mean-square error of approximation (RMSEA) = .001. Teachers' assessment using CEC BEH [S] was a significant predictor of BRIEF results completed by teachers

($\beta = .86$). Similarly, CEC BEH [S] completed by parents was a significant predictor of the results of BRIEF-P questionnaire (completed by parents, $\beta = .66$). Importantly, CEC BEH [S] completed by teachers was a significant predictor of BRIEF-P completed by parents ($\beta = .20$), and CEC BEH [S] completed by parents was also significant, however, it was a less stronger ($\beta = .07$, $p < .05$) predictor of BRIEF-P completed by teachers.

**Figure 4. Distinguishable dyad teacher-parent interdependence analysis model. Completely standardized maximum likelihood parameter estimates**
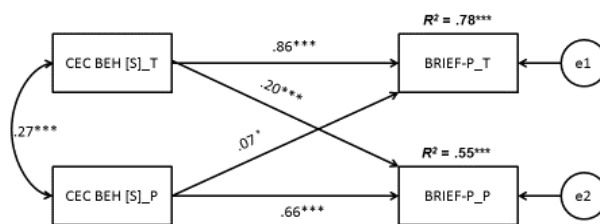


*$p < .05$, **$p < .01$; ***$p < .001$.

CEC BEH [S] T = Conner's Early Childhood Behaviour Scale – Teachers; CEC BEH [S] P = Conner's Early Childhood Behaviour Scale – Parents; BRIEF-P_T = Behaviour Rating Inventory of Executive Function-Preschool – Teachers; BRIEF-P_P = Behaviour Rating Inventory of Executive Function-Preschool – Parents.

### Dyad teacher-parent path model predicting Raven test

The second path model (see Fig. 5) shows the direct and indirect (via effects of BRIEF-P_WM) role of CEC BEH [I/H] as a predictor of fluid intelligence in preschoolers (Raven's CPM). This model had two degrees of freedom; in contrast to the previous model, CEC BEH [I/H] of parents did not predict the BRIEF-P_WM of teachers, and *vice versa* CEC BEH [I/H] of teachers did not predict the BRIEF-P_WM of parents. Also in contrast to the previous model, the residuals (e1 and e2) were significantly correlated. The estimations of goodness of fit for this model were pretty good: $\chi^2 (2) = 4.24$; $p = .12$; Comparative Fit Index (CFI) = .993; Root mean-square error of approximation (RMSEA) = .09. This model demonstrates that the results of working memory subscales of BRIEF-P_WM (completed by both parents and teachers) mediate the

**Table 4. Correlation coefficients between parents and teachers executive functioning assessment for each scale of BRIEF-P questionnaire**

| Scale | Correlation coefficients |
|---|---|
| Inhibition | .47** |
| Switching | .27** |
| Emotional control | .40** |
| Working memory | .36** |
| Planning | .36** |

** $p < .001$

relation between CEC BEH [I/H] subscales of innatention/hyperactivity (completed by both parents and teachers) and fluid intelligence (measured by Raven's CPM). However, the troubles with working memory assessed by teachers were a better predictor of Raven scores than the working memory troubles estimated by parents. In the model, direct effects between CEC BEH [I/H] and Raven are not significant for both teachers' and parents' assessments.

**Figure 5. Dyad teacher-parent dyad model predicting Raven test. Completely standardized maximum likelihood parameter estimates**
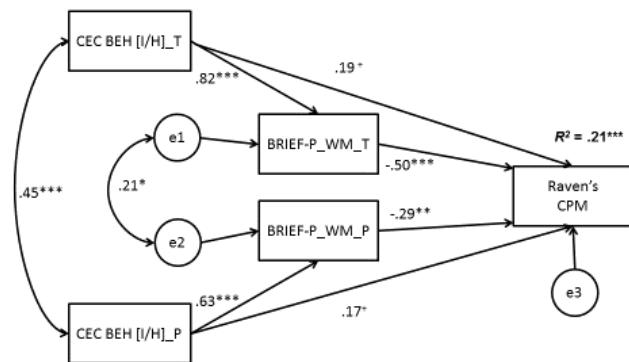


$^+$ p < .1, $*p$ < .05, $**p$ < .01, $***p$ < .001.

CEC BEH [I/H] T = Conner's Early Childhood Behaviour Inattention/hyperactivity subscale – Teachers; CEC BEH [I/H] T = Conner's Early Childhood Behaviour Inattention/hyperactivity subscale – Parents, BRIEF-P_WM_T = Working memory subscale of Behaviour Rating Inventory of Executive Function-Preschool – Teachers, Working memory subscale of BRIEF-P_WM_P = Behaviour Rating Inventory of Executive Function-Preschool – Parents, Raven's CPM = Raven's Coloured Progressive Matrices

## Discussion

In the presented study, we have measured teacher-parent concordance in CEC BEH [S] and BRIEF-P assessments of Polish children aged 4–5. We also used Raven CPM test to estimate fluid intelligence. After conducting a series of analyses, we can conclude that our results suggest low to moderate teacher-parent agreement in both used scales. Teachers' ratings in the CEC BEH [S] subscale inattention/hyperactivity were a better predictor of the children's intellectual potential than parents'. However, working memory estimated by teachers and parents using BRIEF-P mediated between inattention/hyperactivity assessments and fluid intelligence (measured with Raven CPM). Working memory estimated by teachers more strongly mediated the relationship between inattention/hyperactivity assessments and intellectual ability than parents.

CEC BEH [S] and BRIEF-P proved to be rather reliable in estimating the children's behaviour and cognitive functioning. However, the reliability of CEC BEH [S] parents' subscales with Cronbach's alpha for .56 (anxiety) and .59 (social functioning) is rather problematic. Correlations between teacher and parent reports in CEC

BEH [S] and BRIEF-P were low to moderate. ANOVA's conducted on our data indicated that compared to teachers, parents notice more behavioural problems in their children. These results are congruent with conclusions reached in similar studies conducted in English-speaking countries (Grietens et al., 2004), in Asia (Satake, Yoshida, Yamashita, Kinukawa & Takagishi, 2003), and in Germany (Korsch & Petermann, 2014). This suggests a cross-cultural concordance in terms of childhood behaviour assessments conducted by teachers and parents.

The strongest correlation between teacher and parent reports in CEC BEH [S] was reached for the inattention/hyperactivity subscale: $r = 0.44$; $p < .001$. This result was confirmed in two analyses of variance, where a simple effects analysis suggested a lack of significant differences between subscale scores from parent and teacher ratings. Teachers and parents noticed hyperkinesis and inattention in the same children, and scores in this subscale are the best predictor of ADHD risk (Conners, 2009). Independent reports on hyperkinesis and attention deficits coming from children's different environments may serve as a valuable cue in subsequent ADHD diagnostic procedures and early intervention. There are serious theoretical and empirical indications that there is a need to identify those children who may be at risk or may already be suffering from this disorder. This may help alleviate accompanying problems and prevent more serious, negative consequences and comorbit disorders (American Academy of Pediatrics, 2011; DuPaul & Kern, 2011).

We used a series of statistical analyses to estimate teacher-parent concordance. The biggest discrepancies between teacher and parent scores in CEC BEH [S] were found for the defiant/aggressive behaviour subscale. Defiant/aggressive behaviour is classified as an externalizing behaviour. The differences in teacher and parent ratings may stem from differences in children's behaviour in various settings – children may relieve stress in the most safe environment, i.e., at home. Furthermore, this result suggests a dearth of educational models that could help the child deal with negative emotions (Kołakowski & Pisula, 2011). It is possible that children behave differently (i.e., their problems manifest themselves differently) in school and at home because of differences in the adult's attitudes and educational methods used by these groups of adults. Yet another hypothesis about the discrepancies in teacher and parent reports is that parents are more sensitive and less tolerant to undesirable behaviours (Touliatos & Lindholm, 1981).

Significant discrepancies between teacher and parent scores in CEC BEH [S] were also found for the anxiety subscale and in the BRIEF-P emotional control subscale. These two subscales pertain to internalizing behaviours and, congruently with previous research, behaviours of this type are noticed more often by the parents in comparison to the teachers (Grietens et al., 2004; Sawyer, Baghurst & Mathias, 1992).

Correlations between teacher and parent reports are slightly stronger in BRIEF-P than in CEC BEH [S]. In BRIEF-P, we found moderate concordance in BRIEF-P

subscales. The fact that we did not find a stronger level of agreement as well as the results of path analysis suggest that the reports are complementary (Stanger & Lewis, 1993) and that each observer provides unique insight and influences both the general assessment and the assessment of potential problems or developmental deficits (Merrell, 1999). There is still some disagreement on how to consolidate information from different observers (van der Ende, 1999), or how to present descriptions of the child (including discrepancies between parent and teacher reports) so that they are useful for clinicians and intervention planners.

Path analysis indicated that children who were characterized by the observers as having hyperactivity and inattention issues scored lower in the Raven CPM test and that this relationship was mediated by working memory. These findings are similar to the results from a study showing associations between intelligence and working memory in preschool children (Rahbari & Vaillancourt, 2015). The estimations of working memory done by teachers mediate stronger the relationship between estimations of inattention/hyperactivity and fluid intelligence than parents. This means that teacher reports are better predictors of the children's fluid intelligence in comparison to parent reports. Possibly, this stems from the specificity of the teachers' role – observing children as they carry out educational tasks in a group of peers – and so they may compare children to their reference group. Perhaps parents give such educational tasks to their children less often. Children at this age tend to choose their favourite activities when it is difficult to notice working memory deficits, whereas kindergarten education requires the fulfilment of various tasks and not only those that the children would choose themselves. In this context, teachers seem to be the more reliable source of information in comparison to parents. Knowledge about child development is also needed to assess a child's intellectual ability. The teacher's insights are valuable, mostly because they are professional and strictly connected to occupational experience, and they serve a supplemental role to parent reports. Furthermore, teachers observe children among their peers, so they can compare a child to his or her reference group. Teachers should be viewed as a valuable source of correct estimations of children's ability.

The present study had its limitations, and generalizations onto other populations should be done with care. Longitudinal studies are needed to estimate the accuracy and temporal stability of teacher and parent reports. Studies may also be needed to include the characteristics of the relationship between the child and the observer (e.g., quality of the parent-child relationship). Studies indicated that these characteristics can influence the assessments done by parents and teachers (Chilcoat & Breslau, 1997; Richters, 1992; Treutler & Epkins, 2003).

Despite these limitations, our study has important implications for specialists and clinicians. Discrepancies may be influenced by a number of factors, e.g., each person has their own tolerance level and personal standards, which influence how we perceive others (van der Ende, 1999). These assessments may also depend on the knowledge about child development and what we expect of the child. Teacher reports need to be recognized as important sources of information about the children and their intellectual ability. Furthermore, professional knowledge may also increase accuracy of teacher reports of possible issues or problems, especially if they are not severe enough to meet the criteria for disorder diagnosis (Campbell, 2002; Egeland, Kalkoske, Gottesman & Erickson, 1990). Additionally, reports of children from clinical groups should be analyzed. The results can help to improve the guidelines for psychologists and doctors (Korsch & Petermann, 2014).

Parent availability and time spent with the child is important in noticing problems (van der Ende, 1999). Having a closer relationship with the child may increase the awareness of the child's problems, but it may also affect the perception of that child. Parents of preschoolers, because of the greater amount of time spent with their children, maybe more aware of the child's problems, but they may also be more biased in their assessments. Possibly, this explains why parents report children's internalizing problems more often than teachers (Treutler & Epkins, 2003).

Observers' varied knowledge, expectations, and environments may be used by clinicians and diagnosticians to explain discrepancies in assessments. These specialists may also try to establish whether teacher and parent reports are based on knowledge or expectations or whether the children behave differently at home or kindergarten. Problematic behaviours and functioning deficits stem from a variety of factors; therefore, intervention and prevention programs should be aimed not only directly at the children but also at preschool or family environment as well as at those people who reinforce unwelcome behaviours.

## References

Achenbach, T. M. (1995). Empirically based assessment and taxonomy: Applications to clinical research. *Psychological Assessment, 7(3)*, 261–274.

Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101*, 213–232. doi: 10.1037/0033-2909.101.2.213.

Alloway, T. P., & Alloway, R. G. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology, 106*, 20–29.

Alloway, T. P., Elliott, J., & Place, M. (2010). Investigating the relationship between attention and working memory in clinical and community samples. *Child Neuropsychology*, 16(3), 242–254.

Ardila, A., Pineda, D., & Rosselli, M. (2000). Correlation between intelligence test scores and executive function measures. *Archives of Clinical Neuropsychology, 15*(1), 31–36.

Arffa, S. (2007). The relationship of intelligence to executive function and non-executive function measures in a sample of average, above average, and gifted youth. *Archives of Clinical Neuropsychology, 22*, 969–978.

Arffa, S., Lovell, M., Podell, K., & Goldberg, E. (1998). WCST performance in above average and superior school children: Relationship to intelligence and age. *Archives of Neuropsychology, 13*, 713–720.

Barkley, R. A. (2001). The executive functions and self-regulation: An evolutionary neuropsychological perspective. *Neuropsychology Review, 11*, 1–29.

Baron, I. (2003). Neuropsychological evaluation of the child. New York, NY: Oxford University Press.

Biederman, J., Faraone, S. V., Milberger, S., & Doyle, A. (1992). Diagnoses of attention-deficit hyperactivity disorder from parent reports

predict diagnoses based on teacher report. *Journal of the American Academy of Child & Adolescent Psychiatry, 32*, 315–317.

Biederman, J., Keenan, K., & Earaone, S. V. (1990). Parent-based diagnosis of attention deficit disorder predicts a diagnosis based on teacher report. *Journal of the American Academy of Child & Adolescent Psychiatry, 29*, 698–701.

Bodnar, L. E., Prahme, M. C., Cutting, L. E., Denckla, M. B., & Mahone, E. M. (2007). Construct validity of parent ratings of inhibitory control. *Child Neuropsychology, 13*, 345–362.

Briggs-Gowan, M. J., Carter, A. S., & Schwab-Stone, M. (1996, December). Discrepancies among mother, child, and teacher reports: Examining the contributions of maternal depression and anxiety. *Journal of Abnormal Child Psychology, 24*(6), 749–765.

Cai, X., Kaiser, A. P., & Hancock T. B. (2004). Parent and Teacher Agreement on Child Behavior Checklist Items in a Sample of Preschoolers From Low-Income and Predominantly African American Families. *Journal of Clinical Child and Adolescent Psychology, 33*, 303–312.

Campbell, S. B. (2002). *Behavior problems in preschool children. Clinical and developmental issues (2nd ed.)*. New York, United States: Guilford.

Chilcoat, H. D., & Breslau, N. (1997). Does psychiatric history bias mothers' reports? An application of a new analytic approach. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 971–979.

Clinical Practice Guideline (2011). ADHD: Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents. doi: 10.1542/peds.2011-2654.

Conners, C. K. (2009). *Conners Early Childhood. Manual*. North Tonawanda, NY: Multi Health Systems Inc.

Deb, S., Dhaliwal, A. J., & Roy, M. (2008). The usefulness of Conners' Rating Scales-Revised in screening for Attention Deficit Hyperactivity Disorder in children with intellectual disabilities and borderline intelligence. *Journal of Intellectual DisabilityResearch, 52*, 950–965.

Dige, N., Maahr, E., & Backenroth-Ohsako, G. (2008). Memory tests in subgroups of adult attention deficit hyperactivity disorder reveals simultaneous capacity deficit. *International Journal of Neuroscience, 118*(4), 569–591.

DuPaul, G. J., & Kern, L. (2011). *Young Children with ADHD: Early Identification and Intervention*. Washington, DC, United States: American Psychological Association

Duhig, A. M., Renk, K., Epstein, M. K., & Phares, V. (2000). Interparental agreement on Internalizing, Externalizing, and Total Problems: A meta-analysis. *Clinical Psychology: Science and Practice, 7*, 435–453.

Egeland, B., Kalkoske, M., Gottesman, N., & Erickson, M. F. (1990). Preschool behavior problems: Stability and factors accounting for change. *Journal of Child Psychology and Psychiatry, 31*, 891–909.

Epkins, C. C. (1996). Parent ratings of children's depression, anxiety, and aggression: A cross-sample analysis of agreement and differences with child and teacher ratings. *Journal of Clinical Psychology, 52*, 599–608.

Friedman, N. P., Miyake, A., Corley, R. P., Young, S. E., DeFries, J. C., & Hewitt, J. K. (2006). Not all executive functions are related to intelligence. *Association for Psychological Science, 2*, 172–179.

Garon, N., Bryson, S. E., & Smith, I. M. (2008). Executive function in preschoolers: A review using a integrative framework. *Psychological Bulletin, 134*, 31–60.

Gioia, G. A., Espy, K. A., & Isquith, P. K. (2003). *BRIEF-P Behavior Rating Inventory of Executive Functions – Preschool Version. Professional Manual*. Lutz, FL: Psychological Assessment Resources.

Gonzalez, R., & Griffin, D. (2012). Dyadic data analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, K. J. Sher, ... K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol 3: Data analysis and research publication* (pp. 439–450). Washington, DC, US: American Psychological Association.

Greenfield Spira, E., & Fischel, J. E. (2005). The impact of preschool inattention, hyperactivity, and impulsivity on social and academic development: a review.*Journal of Child Psychology and Psychiatry 46(7)*, 755–773.

Greenhouse, S. W., & Geisser, S. (1959). On methods in the analysis of profile data. *Psychometrika, 24(2)*, 95–112.

Grietens, H., Onghena, P., Prinzie, P., Gadeyne, E., Van Assche, V., Ghesquie`re, P., & Hellinckx, W. (2004). Comparison of Mothers', Fathers', and Teachers' Reports on Problem Behavior in 5- to 6-Year-Old Children. *Journal of Psychopathology and Behavioral Assessment, 26*(2), 137–146.

Holmes, J., Hilton, K. A., Place, M., Alloway, T. P., Elliott, J. G., & Gathercole, S. E. (2014). Children with low working memory and children with ADHD: Same or different?. *Frontiers in Human Neuroscience, 8*.

Isquith, P. K., Gioia, G. A., & Espy, K. A. (2004). Executive function in preschool children: Examination through everyday behavior. *Developmental Neuropsychology, 26*, 403–422.

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY, US: Guilford Press.

Kolko, D. J., & Kazdin, A. E. (1993). Emotional/behavioral problems in clinic and nonclinical children: Correspondence among child, parent and teacher reports. *Journal of Child Psychology and Psychiatry, 34*, 991–1006.

Kołakowski, A., & Pisula, A. (2011). *Sposób na trudne dziecko. Przyjazna terapia behawioralna. [Help a difficult child. Friendly behavioral therapy]*. Gdańsk, Poland: Gdańskie Wydawnictwo Psychologiczne GWP.

Korsch, F., & Petermann, F. (2014). Agreement Between Parents and Teachers on Preschool Children's Behavior in a Clinical Sample with Externalizing Behavioral Problems. *Child Psychiatry and Human Development, 45*, 617–627.

Mahone, E. M., & Hoffman, J. (2007). Behavior rating of executive function among preschoolers with ADHD. *The Clinical Neuropsychologist, 21*(4), 569–586.

Merrell, K. W. (1999). *Behavioral, social, and emotional assessment of children and adolescents*. Hillsdale, New York, United States: Erlbaum.

Mitsis, E. M., McKay, K. E., Schulz, K. P., Newcorn, J. H., & Halperin, J. M. (2000). Parent-teacher concordance for DSM-IV attention deficit/hyperactivity disorder in a clinic-referred sample. *Journal of the American Academy of Child & Adolescent Psychiatry, 39*, 308–313.

Naglieri, J. A., Goldstein, S., Delauder, B. Y., & Schwebach, A. (2005). Relationships between the WISC-III and the Cognitive Assessment System with Conners' rating scales and continuous performance tests. *Archives of Clinical Neuropsychology, 20*(3), 385–401.

Narad, M. E., Garner, A. A., Peugh, J. L., Tamm, L., Antonini, T. N., Kingery, K. M, .... Epstein, J. N. (2015). Parent–Teacher Agreement on ADHD Symptoms Across Development. *Psychological Assessment, 27*, 239–248.

Oberauer, K., Süß, H. M., Wilhelm, O., & Wittman, W. W. (2008). Which working memory functions predict intelligence? *Intelligence, 36*, 641–652.

Peugh, J. L., DiLillo, D., & Panuzio, J. (2013). Analyzing mixed-dyadic data using structural equation models. *Structural Equation Modeling, 20*(2), 314–337.

Querido, J. G., Eyberg, S. M., & Boggs, S. R. (2001). Revisiting the accuracy hypothesis in families of young children with conduct problems. *Journal of Clinical Child Psychology, 30*, 253–261.

Rahbari, N., & Vaillancourt, T. (2015). Longitudinal Associations Between Executive Functions and Intelligence in Preschool Children. A Multi-Method, Multi-Informant Study. *Canadian Journal of School Psychology*, 1–18.

Raven, J. C., Court, J. H., & Raven, J. (1986). *Manual for Raven's progressive matrices and vocabulary scales*, Research Supplement No. 3. London: Lewis.

Riccio, C. A., Hall, J., Morgan, A., Hynd, G. W., Gonzalez, J. J., & Marshall, R. M. (1994). Executive function and the Wisconsin Card Sorting Test: Relationship with behavioral ratings and cognitive ability. *Developmental Neuropsychology, 10*, 215–229.

Richters, J. E. (1992). Depressed mothers as informants about their children: A critical review of the evidence for distortion. *Psychological Bulletin, 112*, 485–499.

Rohrer-Baumgartner, N., Zeiner, P., Egeland, J., Gustavson, K., Skogan, A. H., Reichborn-Kjennerud, T., & Aase, H. (2014). Does IQ influence associations between ADHD symptoms and other cognitive functions in young preschoolers? *Behavioral and Brain Functions*, 10.

Salthouse, T. A., Atkinson, T. M., & Berish, D. E. (2003). Executive functioning as a potential mediator of age-related cognitive decline in normal adults. *Journal of Experimental Psychology: General, 132*, 566–594.

Satake, H., Yoshida, K., Yamashita, H., Kinukawa, N., & Takagishi, T. (2003). Agreement Between Parents and Teachers on Behavioral/Emotional Problems in Japanese School Children Using the Child Behavior Checklist. *Child Psychiatry and Human Development, 34(2)*, 111–126.

Sawyer, M. G., Baghurst, P., & Mathias, J. (1992). Differences between informants' reports describing emotional and behavioral problems in community and clinic-referred children: A research note. *Journal of Child Psychology and Psychiatry, 33*, 441–449.

Sherman, E. S., & Brooks, B. L. (2010). Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P): Test review and clinical guidelines for use. *Child Neuropsychology*, *16*(5), 503–519.

Skogan, A. H., Zeiner, P., Egeland, J., Urnes, A., Reichborn-Kjennerud, T., & Aase, H. (2015). Parent ratings of executive function in young preschool children with symptoms of attention-deficit/-hyperactivity disorder. *Behavioral and Brain Functions*, *11*.

Sointu, E., Savolainen, H., Lappalainen, K., & Epstein, M. (2012). Parent, Teacher and Student Cross Informant Agreement of Behavioral and Emotional Strengths: Students With and Without Special Education Support. *Journal of Child and Family Studies, 21*, 682–690.

Spiker, D., Kraemer, D., Constantine, N. A., & Bryant, D. (1992). Reliability and validity of behavior problem checklist as measures of stable traits in low birth weight, premature preschoolers. *Child Development, 63*, 1481–1496.

Stanger, C., & Lewis, M. (1993). Agreement among parents, teachers, and children on internalizing and externalizing behavior problems. *Journal of Clinical Child Psychology, 22*, 107–115.

Szustrowa, T., Jaworowska, A. (2003). *TMK – Test Matryc Ravena w Wersji Kolorowej [CPM – Raven›s Coloured Progressive Matrices]*. Warszawa, Poland: Pracownia Testów Psychologicznych.

Touliatos, J., & Lindholm, B. W. (1981). Concordance of parents' and teachers' ratings of children's behavior problems. *Journal of Abnormal Child Psychology, 9(3)*, 347–354.

Treutler, C. M., & Epkins, C. C. (2003). Are discrepancies among child, mother, and father reports on children's behavior related to parents' psychological symptoms and aspects of parent–child relationships? *Journal of Abnormal Child Psychology, 31(1)*, 13–27.

Verhulst, F. C., & Akkerhuis, G. W. (1989). Agreement between parents' and teachers' ratings of behavioral/emotional problems of children aged 4–12. *Journal of Child Psychology and Psychiatry, 30*, 123–136.

Wechsler, D. (2002). *The Wechsler Preschool and Primary Scale for Intelligence* (3rd ed.). San Antonio, TX: The Psychological Corporation.

Youngstrom, E., Loeber, R., & Stouthamer-Loeber, M. (2000). Patterns and correlates of agreement between parent, teacher, and male adolescent ratings of externalizing and internalizing problems. *Journal of Consulting and Clinical Psychology, 68*, 438–450.