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SEARCHING FOR A MORE VALID FORM OF PARENTAL RATING SCALES OF PRESCHOOLERS' INTELLECTUAL GIFTEDNESS – DEVELOPMENT AND VALIDATION OF THE PRESCHOOLER'S ABILITY RATING SCALE (PARS)

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ABSTRACT

Objectives. The aim of this study was to develop a new parental rating scale for identification of intellectually gifted preschoolers (4 to 6 years of age). This new scale, the Preschooler's Ability Rating Scale (PARS), consists of two parts – PARS-PRE, which follows the principle of precocity and inquires about the age at which giftedness-relevant behavior appeared for the first time; and PARS-CUR, which focuses on the current level of abilities.
Participants and setting. In total, 263 Czech mothers and 90 children participated in the main study.
Hypotheses. PARS will have a two-dimensional structure corresponding to its two parts. Both parts will significantly correlate with scores on the Woodcock-Johnson: International edition II (WJ IE II COG).
Statistical analysis. 1. Item analysis; 2. Exploratory factor analysis; 3. Correlational analyses with WJ IE II COG; 4. ROC analysis to evaluate the specificity and sensitivity.
Results. Factor analysis suggests a three-factor structure – two of the factors correspond to the scale's original parts, and the third factor reflects early reading and counting (4 items from the precocity part). The diagnostic accuracy of the first two factors is similarly low (r_{PRE} = .33, r_{CUR} = .25), but substantially higher for the early reading/counting factor (r_{LIT} = .52). Additionally, parental ratings are, in general, based more on children's verbal abilities than their nonverbal abilities. Given the low criterial validity, the authors do not recommend utilizing the PARS scale in practical setting, however, the conclusions are useful for further development of similarly-minded scales.
Study limitations. Only 90 children were administered the WJ IE II COG – the small sample size affects the precision of parameter estimates. The parents' sample consists only of mothers.

key words:
parental assessment of children,
rating scale,
preschool children,
giftedness,
precocity principle

klíčová slova:
rodičovské hodnocení dětí,
posuzovací škála,
předškolní děti,
nadání,
princip předčasné zralosti

INTRODUCTION

Identification is one of the most important and most discussed topics in the field of giftedness (e.g., Callahan et al., 2017; Cao et al., 2017; Plucker & Callahan, 2014). It is the first of many steps in the care for gifted children, since it is the necessary requirement for subsequent selection of optimal form of intervention. The intervention itself need not necessarily be an inclusion into a special educational track, acceleration, or enrichment (e.g., Southern et al., 1993) – even the day-to-day interaction with the child in a classroom matters. If teachers are aware of the special needs of their students, they can react and appropriately adapt their behavior.

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One of the issues most discussed in this regard is the age from which identification of giftedness becomes meaningful (e.g., Heller & Schofield, 2008). Some authors challenge the notion of early identification, primarily due to the instability of the measured abilities (e.g., Jackson & Klein, 1997; Robinson & Robinson, 1992). However, some longitudinal studies (Freeman, 2001; Gross, 2004) suggest that several difficulties that might emerge from unsuitable pedagogical approaches towards gifted students (such as academic underachievement or social behavior problems; Heller, 2004) can be avoided by early identification. For this reason, most experts recommend beginning with identification before the child enters primary school (e.g., Gross, 1999, 2004; Heller, 2004). With respect to these findings, we believe it is important to look for ways to make early identification more accessible and more credible.

It is important to note that we view giftedness as possession of extraordinary cognitive abilities. We are aware of multidimensional models of giftedness (e.g., Sternberg & Kaufman, 2018) and in no way object to them; nonetheless, the definition was narrowed down to that of intellectual giftedness for the purposes of this paper.

Parental Rating Scales for the Identification of Giftedness

Although intelligence tests and achievement tests are most often used in the assessment of giftedness (NAGC, 2015), the use of rating scales can offer some advantages. Such scales are relatively quick to administer, are less costly, their use often does not require direct supervision by trained personnel, the subject does not need to be assessed in person, and so forth. The most commonly used rating scales are those designed for teachers, parents, peers, and the gifted students themselves (Cao et al., 2017). Since our study focusses on children of preschool age, the raters considered here are teachers and parents.

Parents seem the most suitable raters for preschool-aged children as, unlike teachers, they spend more time with their children and can observe their behavior and abilities in a natural environment. Parents can also provide vital information unavailable to teachers (Chan, 2000), such as closely witnessing the child's development and attainment of developmental milestones (Cao et al., 2017). Parental rating has been shown to predict reliably a wide range of child behavior (e.g., Funderburk et al., 2003; Mooney et al., 2005), especially that connected with disabilities (Glascoe, 2000).

In the area of intellectual giftedness, however, the precision and validity of rating scales have always been the subject of discussion and research (e.g., Acar et al., 2016), and, in some cases, have been seriously doubted (e.g., Jarosewich et al., 2002). It is true that the accuracy of parental ratings tends to be lower than that of teachers' ratings (Acar et al., 2016), and it is also for these reasons that parental rating scales (especially those for parents of preschoolers) are somewhat rare and underutilized in practice (Cao et al., 2017).

However, several reasons exist for continuous research in this area, as it could lead to the development of valid and reliable parental rating scales in the future. The first set of reasons is economic. The use of rating scales can be much more economically efficient than the use of standardized ability tests, especially when parents are the ones who carry out the rating, as this distributes the task between many parents and does not present a significant workload for a single rater. At the same time, parents are typically more motivated to contribute to the assessment than teachers. The second set of reasons is systemic. As noted before, it is most efficient to begin with giftedness assessment as early as possible, i.e., in pre-school age. Naturally, the most suitable raters in this age are parents, who know their child and its behavior arguably best and are well-motivated to carry out assessment. A good-quality rating scale for parents of

preschoolers could become an integral part of the system for education of the gifted. If publicly available, such a scale could serve initial screening purposes and refer parents to a more complex assessment if their child would score above a certain threshold. The third set of reasons relate to the incremental validity rating scales have over ability tests. Unlike intelligence tests, rating scales focus on broader spectrum of abilities and behaviors, which might be more valuable in terms of predictive validity (e.g., better at predicting children's success in gifted programs or educational attainment, see Acar et al., 2016). The fourth and final set of reasons represent the demands the assessment instruments place on children. Unlike ability tests, rating scales require time and mental investment from adults and can thus eliminate potential negative effects assessment might have on children.

Goal of this paper

Due to the unavailability of quality parental rating scales focused on preschoolers, the primary goal of this study is to develop one. Considering the typical validity and diagnostic accuracy of such instruments, which is generally relatively low, we are looking for alternative ways to design such a scale. The majority of similarly-minded rating scales focuses on the child's current abilities and behavior. However, based on a thorough analysis of existing scales and a detailed literature review, we have identified a less usual design of these instruments, which follows the so-called principle of precocity and, as such, inquires about the onset of certain specific behaviors. It is worth noting that only a small minority of ratings scales developed so far have followed this design, although they often showed promising psychometric properties (see below).

The scale we developed, the Preschooler's Ability Rating Scale (PARS), thus constitutes of two parts – the first part focuses on the development of behavior and abilities of the rated child (i.e., follows the principle of precocity), while the second part focuses on their current level. In line with the standard methodology for evaluating diagnostic accuracy (e.g., Pfeiffer & Jarosewich, 2007; Pfeiffer & Petscher, 2008), both parts and the scale as a whole were evaluated with respect to three criteria: correlation with test scores on a complex intelligence test, specificity (the percentage of children identified as non-gifted out of the total number of non-gifted children in the sample), and sensitivity (the percentage of gifted children identified as gifted out of the total number of gifted children in the sample).

Rating Scales Focusing on the Current Behavior or Abilities

As stated above, one of the two possible forms of giftedness rating scales focuses on current behavior or abilities. Instruments following this form assume that with a specific kind of giftedness comes a specific set of behaviors and abilities. For intellectual giftedness, these could be advanced language and reasoning skills, quick understanding and fast learning, insatiable curiosity, etc. (e.g., Perleth et al., 2000). If a child exhibits such behaviors and skills with sufficient frequency and extent, or exhibits them at consistently above-average levels relative to his/her peers, it is assumed that he or she might be gifted.

This form is adhered to all of the most frequently used rating scales (according to Cao et al., 2017) – the Gifted Rating Scales (GRS; Pfeiffer & Jarosewich, 2003), the HOPE Teacher Rating Scale (Gentry et al., 2015), Scales for Rating the Behavioral Characteristics of Superior Students (SRBCSS; Renzulli et al., 2002), Gifted and Talented Evaluation Scales–2nd edition (GATES–2; Gilliam & Jerman, 2015) and the Gifted Evaluation Scale–2nd edition (GES-2; McCarney & Anderson, 1998). However, none of these scales is tailored to be used by parents. Although the "school form" of the GRS (GRS-S)

was also validated on a parent sample (Lee & Pfeiffer, 2006; Li et al., 2008; Petscher & Li, 2008), it was originally developed for use by teachers, which explains its frequent focus on school-related behavior. Two scales not listed above but intended for use by parents are the Scales for Identifying Gifted Students (SIGS; Ryser & McConnell, 2004; more heavily focused on academic skills and thus more appropriate for teachers) and the Characteristics of Giftedness Scale (CGS; Silverman, 1993), which is practically the only existing parental scale for preschoolers. As such, the shortage of scales available for parents of preschoolers is evident (Cao et al., 2017).

As far as the scales' diagnostic accuracy is concerned, moderately strong correlations are often reported. For instance, the SIGS scale manual (Ryser & McConnell, 2004) reports a correlation of $r = .51$ for the Wechsler Intelligence Scale for Children–Third Edition (WISC–III; Wechsler, 1991), and the Czech version (Havigerová, 2014) of the CGS scale (Silverman, 1993) correlates $r = .45$ with the same test. Clearly, diagnostic accuracy of these scales is limited. We assume one of the reasons for this to be the obvious fact that ratings carry a certain error on the rater's side.

One potential source of error is carrying stereotypes about the rated subjects. For example, boys might be better rated in mathematical abilities than girls, although their abilities are comparable (Frome & Eccles, 1998; Herbert & Stipek, 2005; Tiedemann, 2000). Similarly, a halo effect might occur (e.g., Babad et al., 1989), manifested by observing high correlations between facets of giftedness that should not be strongly related, such as intellectual and artistic or social abilities (Benson & Kranzler, 2017; Neber, 2004). Although this effect is stronger in teachers, it can also be observed in parents (Chan, 2000; Petscher & Li, 2008). Additionally, parents' conscious or unconscious desire to have their children recognized as gifted can impact measurement (Cao et al., 2017). We assume that the second possible form of rating scales could, given its design, be less susceptible to these biases.

Rating Scales Based on the Precocity Principle

Some empirical research in the area of giftedness suggest that exceptionally gifted individuals can show, in comparison with normal population, certain developmental peculiarities (e.g., Dalzell, 1998; Koshy & Robinson, 2006). Studies that report this are not only retrospective (e.g., Gross, 2004), but also longitudinal (e.g., Gottfried et al., 2006). Generally, this can be referred to as the so-called precocity principle (e.g., Brody & Stanley, 2005), where it is assumed that gifted children exhibit certain behaviors earlier than it is usual. Behaviors most frequently mentioned in this respect are early reading or early interest in letters (e.g., Harrison, 2004), and early counting (e.g., Silverman & Golon, 2008), however, in general this means faster cognitive development and a higher level of cognitive abilities in early age, relative to peers (Steiner & Carr, 2003). Additionally, some studies suggest this need not be limited to cognitive abilities, but could also affect, for example, motor skills (Gross, 2004; Robinson, 2008).

Nevertheless, scales that would specifically inquire about the age range in which such giftedness-relevant behavior first occurred are nonexistent. Those relatively rare research efforts (Benito & Moro, 1999) resulted in the development of virtually the only well-known scale containing items that concern the development of behavior – the Personality Development of Preschool Children Questionnaire (PDPCQ; Stapf & Stapf, 1990, as cited in Breik, 1997) from Germany.

The PDPCQ itself is not a novel scale, and its use is not widespread, even though its reported characteristics are promising. For example, Čihounková (2012) reports a correlation of $r = .54$ with the international edition of the Woodcock–Johnson II: Tests

of Cognitive Abilities (WJ IE II COG; Ruef & Furman, 2010; Ruef et al., 2010) and Nováková (2005) reports a correlation of $r = .61$ with the Stanford-Binet test (SB; Thorndike et al., 1995). A Jordanian version (Breik, 1997) reports a range of correlations from $r = .75$ to $r = .82$ with the SB test.

However, the precocity-based design of rating scales has its share of limitations and possible sources of bias. Retrospective inquiry could be less reliable than rating of present events due to memory effects (Dale et al., 1989; Gross, 2000). Furthermore, it remains questionable whether precocity in some area of development is connected with later intellectual giftedness strongly enough for to be of value in real-world assessment setting. Given the relatively high correlation of the PDPCQ with complex intelligence tests, we consider it important to try to shed more light on this issue.

METHODS

Preschooler's Ability Rating Scale (PARS)

The Preschooler's Ability Rating Scale (PARS) is intended for parental assessment the behaviors and abilities of 4 to 6-year old children. The scale consists of two parts. One part (PARS-PRE) is based on the principle of precocity, while the other part (PARS-CUR) includes questions on the current frequency or intensity of a specific behavior or ability.

The scale's items were developed based on a detailed analysis of extant rating scales and thorough literature review on both possible forms of rating scales, as described above. Their content was chosen to correspond with that which is, according to available empirical research, most closely related to intellectual giftedness. Another important criterion for item development was intelligibility and unambiguity. The items were primarily phrased to assess behaviors easily observable by parents. This approach distinguishes the PARS from scales such as the GRS-P (Pfeiffer & Jarosewich, 2003) or the SIGS (Ryser & McConnell, 2004), which are mostly focused on academic abilities. Table 1 provides an overview of the items, their wording, content area, and references to empirical studies which support the link between the particular behavior and giftedness.

The pilot version of the PARS consisted of 37 items: 20 in the PARS-PRE and 17 in the PARS-CUR. The scale was piloted on 65 parents of children between four and six years 11 months of age. Based on item analysis, items with low corrected item-total correlations were discarded. The remaining 26 items formed the basis of the final version: 12 in the PARS-PRE and 14 in the PARS-CUR. The response scale of the PARS-PRE items was five-point (1 – *later/our child is not able to yet*, 2 – *during the 4th year*, 3 – *between 3–4 years*, 4 – *between 2.5–3 years*, 5 – *before the age of 2.5 years*), while that of the PARS-CUR was four-point (1 – *Definitely no*, 2 – *Likely no*, 3 – *Likely yes*, 4 – *Definitely yes*).

In further analyses, raw summed scores for both subscales and the entire scale were used, since item loadings or weights estimated using factor or IRT models would likely be biased due to the small sample size (e.g., Dobie et al., 1986). The use of summed scores, however, is a standard approach taken with psychological scales. The scale's reliability is discussed in the Results section.

Woodcock-Johnson: International Edition II – Tests of Cognitive Abilities (WJ IE II COG)

The WJ IE II COG (Ruef & Furman, 2010; Ruef et al., 2010) contains localized tests selected from the Woodcock–Johnson III: Test of Cognitive Abilities (Woodcock et

Table 1 Overview of the Items of Both Parts of PARS

Item ID	Item wording	General topic	Support in research literature
A) PARS-PRE – part focusing on the development of behavior or abilities (precocity principle)			
PRE01	Our child understood the meaning of all words indicating family relations – brother, sister, grandfather, gradmother, uncle, or aunt – approximately:	Vocabulary and verbal reasoning	Oğurlu & Çetinkaya, 2012; Rogers & Silverman, 1998; Sankar-DeLeeuw, 2004; Silverman, 2003; Silverman & Golon, 2008
PRE02	Our child was able to solve problems focused on the relationships between words, such as "car drives, but an airplane (flies)", "the opposite of up is (down)", "the opposite of inside is (outside)", etc., approximately:		
PRE03	Our child correctly understood semantic categories and was able to correctly complete sentences such as "a table is (a piece of furniture)", "a lion is (an animal)", "a rose is (a flower), (a flower) is a plant", etc., approximately:		
PRE04	Our child was able to correctly name six colors approximately:		
PRE05	Our child began to be interested in how things are called approximately:		
PRE06[a]	Our child began to walk independently without support approximately:	Gross and fine motor skills	Gross, 2000, 2004; Robinson, 2008
PRE 07[a]	Our child was able to use scissors independently approximately:		
PRE08	Our child was able to count to ten approximately:	Mathematical abilities	Harrison, 2004; Oğurlu & Çetinkaya, 2012; Rogers & Silverman, 1998; Silverman, 2003; Silverman & Golon, 2008
PRE09	Our child was able to correctly solve a mathematical problem such as 6+2=8 approximately:		
PRE10[a]	Our child was able to correctly solve a mathematical problem such as 6-2=4 approximately:		
PRE11[a]	Our child was able to correctly solve a mathematical problem such as 6x2=12 approximately:		
PRE12[a]	Our child was able to correctly solve a mathematical problem such as 6:2=3 approximately:		
PRE13[a]	Our child said his/her first continuous sentence (with three or more words) approximately:	Speech	Gottfried et al., 2006; Gross, 1999, 2004
PRE14	Our child was able to hold a longer conversation (at least 3 minutes long) with an adult approximately:		
PRE15	Our child was able to recognize most of the capital print letters approximately:	Interest in letters and reading	Harrison, 2004; Oğurlu & Çetinkaya, 2012; Rogers & Silverman, 1998; Silverman & Golon, 2008
PRE16	Our child began to correctly read entire words written in print letters (i.e., correctly connect the letters into a word) approximately:		
PRE17	Our child began to correctly read entire sentences (written in print letters) approximately:		
PRE18	Our child was able to correctly assemble a jigsaw puzzle consisting of at least 20 pieces approximately:	Visuo-spatial ability	Harrison, 2004; Rogers & Silverman, 1998; Silverman, 2003; Silverman & Golon, 2008
PRE19[a]	Our child was able to correctly tell time from an analog wall clock (quarter past, half past, quarter to, ...) approximately:	Spatial and temporal orientation	Stapf & Stapf, 1990; as cited in Breik, 1997
PRE20[a]	Our child was able to correctly distinguish between left and right approximately:		

Item ID	Item wording	General topic	Support in research literature
B) PARS-CUR – part focusing on current behavior or abilities			
CUR01	Our child is highly interested in the world around him/her (e.g., how things work or how they came to be, looking for connection between things and events, etc.).	Curiosity	Gottfried & Gottfried, 2004; Harrison, 2004; Rogers & Silverman, 1998; Silverman, 2003
CUR02	Our child is highly interested in the meaning of new, complicated words (words that similarly old children are not interested in).		
CUR03	Our child likes to try new activities (e.g., hobbies, games, etc.).		
CUR04	The interests of our child are very different from those of his/her peers.	Interests more appropriate for older children	Rogers & Silverman, 1998; Silverman, 2003
CUR05	Out child prefers different kinds of games than his/her peers.		
CUR06	Our child is able to focus on solving a difficult task for an extended period of time.	Intrinsic motivation	Gottfried & Gottfried, 2004; Gottfried et al., 2006
CUR07	Our child likes to learn new poems, songs, jokes, or stories.		
CUR08	When our child is convinced he/she is right, he/she can use substantive arguments.	Verbal abilities and reasoning	Harrison, 2004; Oğurlu & Çetinkaya, 2012; Passow & Frasier, 1996; Tucker & Haferistein, 1997
CUR09	Our child frequently surprises me with unusual questions or thoughts.		
CUR10	Before our child begins an activity (e.g., solo play, playing with others, a trip, a visit, etc.), he/she likes to plan its course and potential risks	Metacognition	Schraw & Graham, 1997; Steiner & Carr, 2003
CUR11[a]	Our child prefers the friendship of older children.	Preference for older persons	Oğurlu & Çetinkaya, 2012; Sankar-DeLeeuw, 2004; Silverman, 2003; Silverman & Golon, 2008; Rogers & Silverman, 1998
CUR12	Our child prefers to converse with adults rather than his/her peers.		
CUR13	When our child learns a new game (e.g., a card game or a board game), it is extensively interested in its rules..	Rules and fairness	Kitano, 1985; Silverman & Golon, 2008
CUR14	Our child has outstanding memory (e.g., for poems, jokes, or stories).	Memory	Harrison, 2004; Oğurlu & Çetinkaya, 2012; Rogers & Silverman, 1998; Silverman, 2003; Silverman & Golon, 2008
CUR15	Our child is very creative (e.g., likes to invent new games, come up with original stories, jokes, etc.).	Creativity	Harrison, 2004; Oğurlu & Çetinkaya, 2012; Rogers & Silverman, 1998
CUR16[a]	Our child has a refined sense of humour (e.g., understands jokes quickly).	Humor	Neihart, 2008; Rogers & Silverman, 1998; Silverman, 2003
CUR17[a]	Our child is highly sensitive to the feelings and needs of others.	Socioemotional abilities	Oğurlu & Çetinkaya, 2012; Porter, 2005

[a] These items were included in the pilot study but subsequently dropped.

al., 2003). This test is a complex intelligence test based on the C-H-C theory (e.g., McGrew, 2009). According to this theory, cognitive abilities can be distinguished on three levels or strata: 1) highly differentiated, "narrow" abilities (e.g., deductive reasoning); 2) more general "broad" abilities (e.g., fluid intelligence); and 3) general ability (the "g factor"). The WJ IE II COG comprises eight subtests measuring the narrow abilities, which are also representations of seven broad abilities: Verbal abilities, Memory for names, Spatial relations, Sound patterns, Concept formation, Visual matching, Numbers reversed and Quantitative reasoning. A score for three test scales (Verbal abilities, Reasoning skills, Cognitive effectiveness) and the overall IQ can also be calculated. See the supplemental material for an overview of the subscales, scales, and their sample statistics.

Data Collection and Participants

The study participants were Czech children between 4 and 6 years 11 months of age and their parents. The data were collected by two different means. The first part of the sample was obtained in 17 kindergartens across the country. The study's aims also necessitated the recruitment of children who appear to be above average in their intellect or, ideally, children who are intellectually gifted. As such, the second part of the sample was obtained in a local Giftedness Centre[1] ran by the Department of Psychology, Masaryk University. Data from the two samples were analysed jointly.

The scale was completed by 277 parents, out of whom only 14 (~5%) were fathers. Given the small number of participating fathers, we decided to keep only the responses of mothers, and thus, conclusions made here should be generalized entirely to mothers. Out of 263 mothers, only 90 gave consent to the administration of the WJ IE II COG.

Boys constituted 56% (n = 147) of the children in the sample. Sixty (23%) of the sampled children were four-year-olds, 110 (42%) were five-year-olds, and 93 (35%) were six-year-olds.

Naturally, we wanted to establish whether the sample size would be sufficient for conducting a reasonable exploratory factor analysis. One of the commonly reported rules of thumb is a subjects:items ratio of 4:1 or larger (MacCallum et al., 2001). However, the optimal ratio is influenced by many other factors that are not as easily estimable beforehand, such as item communalities. With high communalities, stable solutions can be obtained even with relatively smaller samples (see also Mundfrom et al., 2005). With 26 items comprising the PARS and with two expected factors (i.e., an item/factor ratio of 13:1), the minimum sample size can be estimated at 35 to 60 respondents, based on the overall size of item communalities. As such, we consider the size of our sample sufficient even if there were a higher number of extracted factors (see below).

To test our hypotheses, the rated children had to be categorized with respect to the presence or absence of intellectual giftedness, for which the score on the WJ IE II COG served as a criterion. The cutoff total score of 130 (i.e., two standard deviations above the mean) was chosen for this purpose, as it is a commonly accepted standard in the educational field. This cutoff is also used in standard practices for identifying gifted children in the Czech Republic. Out of the total of 90 children who were administered the WJ IE II COG, nineteen reached this cutoff.

[1] The Giftedness Centre is a counselling organisation for parents who are in need for services related to giftedness and gifted children.

Data Analysis

First, we performed an item analysis of the PARS scale and investigated its factor structure using IBM SPSS 23 with an ordinal factor analysis plugin (Basto & Pereira, 2012). Despite our expectations, the analysis suggested three factors: one (here referred to as F1/LIT) with three items measuring early reading and one item measuring early mathematical abilities; one (here referred to as F2/PRE) that best corresponds to the original PARS-PRE part; and one (here referred to as F3/CUR) that corresponds to the original PARS-CUR part (for more details, see Results).

Subsequently, we estimated the internal consistency of the three factors and the total score. To assess the relationship between the PARS scale and the WJ IE II COG, we performed correlational analyses. Finally, an ROC analysis was performed using the MedCalc Statistical Software (version 18.11.6) to evaluate the specificity and sensitivity of the PARS scale (and its factors) as a screening tool for identifying intellectually gifted children. The optimal cutoff score was selected using the Youden index (Youden, 1950) to maximize sensitivity and specificity values. Using pairwise comparisons of the ROC curves according to DeLong, DeLong, and Clarke-Pearson (1988) for all PARS factors, we investigated whether any one of the factors was more useful for the identification of intellectually gifted children than the other factors.

RESULTS

Item Analysis, Factor Structure, and Reliability

The item analysis did not reveal any items of problematic nature. The corrected item-total correlations ranged from $r = .31$ to $r = .66$ ($Md = .48$). Prior to the actual factor analysis, a number of methods - parallel analysis (Horn, 1965), optimal coordinates, comparison data analysis (Ruscio & Roche, 2012), and Velicer's MAP (for an overview, see Courtney, 2013) - were used to determine the optimal number of factors to extract. We expected a 2-factor structure (corresponding to the two PARS scale parts), however, the most plausible number of suggested factors was three. An ordinal exploratory factor analysis using polychoric correlations was performed, with ML estimation and oblique Geomin rotation. The factor loadings of CUR04 (the differences of child's interests from those of their peers) and CUR06 (the child's ability to concentrate when solving a difficult task) items from the PARS-CUR subscale were close to zero, as such, the items were excluded from further analyses. The fit indices of the model without said items were as follows: $GFI = .859$, $RMSR = .053$, $RMSP = .086$. The first factor consisted of four items from the PARS-PRE part focused on early reading (PRE15 - knowledge of capital print letters, PRE16 - reading of words, PRE17 - reading of sentences) and mathematical abilities (PRE09 - adding two numbers); therefore, we labeled this factor F1/LIT ("literacy"). The second factor, F2/PRE, was comprised by the remaining eight items of the PARS-PRE part, likely due to their highly similar format. The third factor, F3/CUR, consisted of the 12 items from the PARS-CUR part. Table 2 lists the factor and total score reliabilities along with other descriptives. For factor loadings of all items, see Table 3.

Correlational Analyses

Table 4 shows correlations between the PARS factors and the WJ IE II COG scores. The median correlations for the F1/LIT, F2/PRE, and F3/CUR factors were $r = .42$, $r = .26$, and $r = .19$, respectively. The median correlation for the total PARS score was $r = .31$. While interpreting the results, it is important to consider the inflation of Type I error.

Table 2 Factor Loadings of PARS Items

Item	F1/LIT	F2/PRE	F3/CUR
PRE16	**-.95**	-.04	-.03
PRE17	**-.76**	.00	-.04
PRE15	**-.64**	.05	.10
PRE09	**-.46**	.25	.01
PRE02	.08	**.89**	-.04
PRE03	.03	**.79**	.04
PRE01	-.03	**.62**	.02
PRE14	.01	**.57**	.12
PRE04	-.10	**.55**	.04
PRE05	-.01	**.52**	.24
PRE08	-.17	**.46**	.00
PRE18	-.09	**.41**	-.03
CUR12	.05	-.08	**.72**
CUR09	.01	-.02	**.69**
CUR02	-.04	.15	**.66**
CUR01	.09	.09	**.65**
CUR08	.05	-.02	**.61**
CUR14	-.15	.03	**.54**
CUR15	-.07	.00	**.53**
CUR10	-.15	-.14	**.48**
CUR03	.05	.09	**.43**
CUR13	-.15	.00	**.35**
CUR05	-.29	.03	**.33**
CUR07	.00	.05	**.32**

Table 3 Factor Structure of the PARS Scale and Factor Reliabilities

Factor	Number of highly loading items	Factor description	Cronbach alpha	Min/Max[a]	M[a]	SD[a]
F1/LIT	4	Early literacy and math skills	.75	4/15	5.82	2.19
F2/PRE	8	Precocity	.85	10/40	29.09	5.55
F3/CUR	12	Current level of abilities and behavior	.84	18/47	35.72	5.49
Total score	24		.91[b]	37/95	70.62	10.82

[a] raw score. [b] Stratified Cronbach alpha.

Table 4 Correlations of the Three PARS Factors with WJ IE II COG Subtests and Scales

	PARS				WJ IE II COG										
	F1/ LIT	F2/ PRE	F3/ CUR	Total PARS score	Verbal ab.[a]	Memory for names	Spatial relations	Sound patterns	Concept formation	Visual matching	Numbers reversed	Quant. reasoning	Reas. skills	Cogn. effect.	Total IQ
F1/LIT	1														
F2/PRE	.49**	1													
F3/CUR	.39**	.51**	1												
Total PARS score	.63**	.86**	.85**	1											
Verbal ab.[a]	.46**	.44**	.37**	.52**	1										
Memory for names	.40**	.32**	.12	.32**	.38	1									
Spatial relations	.41**	.30**	.24*	.37**	.56**	.24*	1								
Sound patterns	.32**	.16	.17	.24*	.33**	.32**	.31**	1							
Concept formation	.26*	.26*	.21*	.30**	.68**	.39**	.56**	.31**	1						
Visual matching	.45**	.16	.09	.24*	.38**	.41**	.33**	.18	.46**	1					
Numbers reversed	.42**	.15	.11	.23*	.53**	.36**	.61**	.47**	.52**	.47**	1				
Quant. reasoning	.59**	.26*	.19	.37**	.62**	.48**	.62**	.39**	.61**	.66**	.71**	1			
Reas. skills	.45**	.35**	.27*	.42**	.69**	.60**	.72**	.68**	.85**	.48**	.67**	.72**	1		
Cogn. effect.	.49**	.17	.12	.26*	.55**	.43**	.59**	.43**	.56**	.73**	.95**	.79**	.69**	1	
Total IQ	.52**	.33**	.25*	.42**	.783**	.56**	.72**	.58**	.79**	.62**	.85**	.82**	.93**	.89**	1

Note. $n_1 = 263$ for PARS, $n_2 = 90$ for WJ IE II COG. These are uncorrected correlations.

[a]Verbal abilities are also included as a scale, * $p < .05$. ** $p < .01$.

ROC Analysis and ROC Curves Comparison

To compare better the diagnostic accuracy of the factors and the total PARS score, we conducted an ROC analysis. Attaining the WJ IE II COG cut-off score served as the classification variable. See Table 5 for an overview of the ROC analyses.

Table 5 Results of the ROC Analyses

	AUC	SE	95% CI (AUC)	Sensitivity	95% CI (sensitivity)	Specificity	95% CI (specificity)
F1/LIT	.764	.059	.662 – .847	57.89	33.5 – 79.7	84.51	74.0 – 92.0
F2/PRE	.678	.070	.571 – .772	68.42	43.4 – 87.4	64.79	52.5 – 75.8
F3/CUR	.610	.080	.501 – .711	52.63	28.9 – 75.6	70.42	58.4 – 80.7
Total PARS score	.688	.075	.581 – .781	57.89	33.5 – 79.7	83.10	72.3 – 91.0

Note: $n = 90$; AUC = area under the ROC curve

Pairwise comparisons of the AUC values showed two statistically significant differences – between the F1/LIT and F3/CUR factors ($p < .05$), and between the F3/CUR factor and the total PARS score ($p < .05$).

SUPPLEMENTAL MATERIAL

Table with detailed information on the WJ IE II COG battery (along with our sample statistics) and the data that support the findings of this study are openly available on figshare at https://figshare.com/s/779a873d7dc8159f3a3a.

DISCUSSION AND CONCLUSION

The primary purpose of the study was to develop a new rating scale for identification of intellectual giftedness aimed at parents of preschoolers. When the summed score of the new scale, PARS, was used, its sensitivity and specificity reached 57.89% and 83.10%, respectively. With respect to sensitivity, it can be seen that almost half of the children who were identified as gifted using WJ IE II COG were not identified as such using PARS. As such, unfortunately, the PARS scale is not currently suitable for use in practice.

We believe, however, that our study can still offer interesting conclusions useful for the development of rating scales in the domain of giftedness. Using pairwise comparisons of ROC curves, we investigated whether any one of the PARS factors is more closely related to cognitive abilities. We did not find a significant difference between the F2/PRE factor (which is based on the precocity principle and focuses on the development of behavior or abilities) and the F3/CUR factor (which focuses on current behavior and abilities). This result is fairly surprising, as the two PARS parts markedly differ in form and in their underlying principles (by focusing on different aspects of a child's abilities and behavior). Moreover, the F2/PRE factor is more loosely related to the test of cognitive abilities than we expected (when compared to correlations reported for the PDPCQ scale, which also follows the principle of precocity; Stapf & Stapf, 1990; as cited in Breik, 1997). It should be noted, however, that the correlations with the WJ IE II COG are affected by the reliability of the F2/PRE and F3/CUR factors (although they were comparable in this respect). Furthermore, four PARS items originally thought to comprise the PARS-PRE part formed a stand-alone factor, F1/

LIT, and thus were not included in these comparison. It should be noted, then, that the F2/PRE factor is not identical (from a content perspective) to the PARS-PRE and, as far as content validity goes, does not represent all important aspects of the precocity principle. At the same time we would like to point out that, by comparing factors, we are not actually solely comparing the diagnostic accuracy of different item formats, but also of different item contents – as the items of the two factors focus on different behaviors and abilities.

Given the relatively weak relationship of the F2/PRE and F3/CUR factors with scores on the intelligence test, it can be concluded that parental rating is affected by many other influences. For ratings on the F3/CUR factor, one could expect bias stemming from the parent's conscious or unconscious desire to have their children recognized as gifted (Cao et al., 2017). The F2/PRE factor items are formulated more objectively, it is, however, probable that its accuracy is affected in some other way. As stated before, the accuracy of retrospective inquiry can be worse due to memory effects (Dale et al., 1989; Gross, 2000). We can hypothesize that similar sources of bias that might influence the rating of present events can be detrimental in the case of the F2/PRE factor as well. For instance, parents can retrospectively view their child's development in a more positive light if convinced about the child's extraordinary abilities. In this respect, the relatively high internal consistency of the PARS-PRE is noteworthy, even though it is questionable whether development in all the inquired areas is indeed so related. This argument is put forth by Perleth, Schatz, and Mönks (2000), who suggest formulating the baseline probability of observing each such "indicator" of giftedness among gifted children and using this information in the form of weights while scoring responses.

The idea that some behavior is more important than others is also corroborated by us in this study. The expected two-factor structure of PARS was not supported in favour of a solution containing an additional "literacy" factor, F1/LIT. This factor is constituted by three items tapping early reading and one item tapping early counting – all originally designed as parts of the PARS-PRE. Seemingly, the item content overshadowed item form in this case, giving way to an additional factor. The F1/LIT factor showed stronger correlation with the WJ IE II COG scores in general and has shown to be a better predictor of whether a child was classified as "intellectually gifted" than the F3/CUR factor when comparing the ROC curves. Although not the purpose of this study, such a result is in line with other findings (for review, see Olson et al., 2006) reporting the relationship between early reading and counting and above-average performance in intelligence assessment. Based on the above, it seems that the degree to which a rating scale relates to scores on an intelligence test is less a matter of the principle from which it stems and more of the content of its items. Our research suggests that school-oriented behaviors (e.g., writing or counting) better represent early intellectual giftedness than other behaviors.

We have also found a relatively strong relationship of all three PARS factors with the verbal abilities subtest of the WJ IE II COG (see Table 4). In the cases of F1/LIT and F2/PRE, this observation might be due to items content, as most items in these factors are related to verbal abilities. However, this explanation cannot be used in case of F3/CUR, where such items constitute a minority. Previous research on teachers' ratings (e.g., Hernández-Torrano et al., 2013; Hodge & Kemp, 2006) suggests that rating is based more on verbal abilities of children than on nonverbal abilities. According to some authors (Koshy & Robinson, 2006; Silverman & Golon, 2008), parents are more sensitive towards those behaviors of their child that are seen as distinctive milestones and normative expectations, like vocabulary or reading abilities, rather than

less salient abilities such as spatial reasoning or memory. The child's verbal abilities, then, can have a higher weight in ratings overall.

Limitations

One of the most substantial limitations of this study is the sample used. Only 90 children were administered the WJ IE II COG. The small sample size affects the precision of parameter estimates (AUC, sensitivity, specificity, etc. – to make the imprecision more explicit, we presented confidence intervals in Table 5), which should be considered when interpreting the results. Second, the sample itself does not represent the general population, certainly not the subjects for whom the WJ IE II COG scores were available – most of these subjects (78%) were recruited from the local Giftedness Centre, and the children score above average on the WJ IE II COG (total score mean of M = 117.03). Thus, our results are of limited generalizability. However, given how these participants were recruited, the parents should represent rather typical users of rating scales if used as screening tools for the identification of intellectually gifted children.

In terms of sample composition, it should be noted that mostly mothers participated in our research, to the extent to which we only retained ratings from mothers for the final analyses to achieve greater sample homogeneity. This should be kept in mind when interpreting the results.

It is likely that some of the PARS items will show differential item functioning in different populations (e.g., the jigsaw puzzle item might work differently for children from less intellectually stimulating background). Thus, for any valid future use of the instrument, the measurement invariance over different populations also needs to be assessed.

Lastly, it might be emotionally difficult for some parents to rate one's child as average or even below average in certain skills, especially if these skills are deemed important. In our study during the data collection phase, two parents voiced their unwillingness to fill out the PARS-CUR scale, as they did not wish to rate their child negatively. This hesitance is also apparent in the distribution of responses to an optional question that was also administered, "Do you think your child is in many respects more skillful than his/her peers?" to which only two parents answered "definitely no". As such, some parents might overestimate their children's skills and abilities, or they might refuse to participate in data collection altogether if they feel that their responses should be negative. This limitation would make the PARS-PRE more suitable for certain forms of screening, as it does not require direct comparison with the child's peers. Precocity-based scales require a certain type of comparison as well (i.e., comparing a child's development with normal development), but parents need not directly perform the comparison, as they simply report when a specific behavior first occurred.

CONCLUSION, PRACTICAL IMPLICATIONS AND FURTHER RESEARCH

The primary goal of this study was to develop a new instrument for parental identification of intellectually gifted preschoolers aged 4 to 6 years. On the basis of reported psychometric properties, however, we do not recommend using the instrument in practice. Although there seems to be a significant link between parental ratings and intelligence test scores, the two methods seem, to some extent, to identify as gifted quite different children (e.g., Acar et al., 2016). Although this conclusion is rather pessimistic, our study also brings some positive findings. It is clear that a certain group of items shows a higher diagnostic accuracy than others. These are the precocity-based items on early reading and early mathematical abilities, which were found to be the

most closely related to the scores on an intelligence test in our study. Thus, we assume that early school-oriented behaviors might be an important predictor of intellectual giftedness and could serve as an easy-to-observe indicator of potential giftedness. These signs should be routinely included in parental rating scales. Apart from their large correlation with the intelligence test scores, we consider including items of this kind in rating scales important for two reasons: to increase content validity and to enable the rater not to perform the potentially emotionally tasking comparison of their child with the child's peers.

It would be worthwhile to develop and validate a rating scale focusing solely on early school-oriented behaviors such as early reading and mathematical skills. Each of these areas should be investigated in greater detail, for example, early reading should cover all pre-school reading-related skills (such as phonological awareness, the alphabetic principle, letter knowledge, text comprehension, etc.) and other relevant factors (such as whether a child began to read by themselves).

The design of this study was aligned with how are rating scales commonly used in practice – as screening instruments which help identify students for subsequent, more thorough and time-consuming, intelligence assessment (see Renzulli & Gaesser, 2015). It is true that this approach is consistently criticised by some authors since the 80's (Renzulli & Delcourt, 1986) well into the present (e.g., Gentry & Mann, 2008). According to these authors, the profiles of gifted children identified using intelligence tests and ratings scales differ and these methods should be administered in parallel rather than in sequence. Assuming this is true, it would not even make much sense to judge validity and accuracy of rating scales with intelligence tests as criterion. It would be more suitable to focus on predictive validity, such as the ability of a rating scale to predict success in special gifted education programs or success in later academic or professional life (Renzulli & Delcourt, 1986; Renzulli & Gaesser, 2015). Such longitudinal studies are, however, very financially demanding. Alternatively, one could give up on screening using rating scales in favor of mass testing using achievement and intelligence tests. Commonly, the tests used for this purpose include TOMAGS (Ryser & Johnsen, 1998) or SAGES-3 (Johnsen & Corn, 2019), in the Czech Republic specifically TIM[3–5] (Cígler et al., 2017) or Invenio (Jabůrek et al., 2020), however it is also possible to use any sufficiently difficult group-administered intelligence test, such as CFT 20-R (Fajmonová et al., 2015).

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SOUHRN

Pátrání po validnější formě rodičovské škály pro posouzení intelektového nadání v předškolním věku – vývoj a validizace metody Preschooler's Ability Rating Scale (PARS)

Cíle. Cílem studie bylo vytvoření nové posuzovací škály pro identifikaci nadaných předškoláků ve věku 4-6 let. Tato nová metoda, Preschooler's Ability Rating Scale (PARS), má dvě části. První je PARS-PRE, která vychází z principu předčasné zralosti a její položky se zaměřují na věk, ve kterém rodiče poprvé pozorovali určité projevy chování, které mohou souviset s nadáním. Druhá je PARS-CUR, která se zaměřuje na aktuální úroveň schopností.
Vzorek. Do hlavní části studie bylo zapojeno celkem 263 matek a 90 dětí z České republiky.
Hypotézy. Posuzovací škála PARS bude mít dvoudimenzionální strukturu odpovídající jejím dvěma částem. Obě části budou silně korelovat se skóry baterie Woodcock-Johnson: International edition II (WJ IE II COG).
Analýzy. 1. Položková analýza; 2. Explorační faktorová analýza; 3. Korelace s WJ IE II COG; 4. ROC analýza ke stanovení specificity a senzitivity.
Výsledky. Výsledky faktorové analýzy naznačují třídimenzionální strukturu – dva faktory odpovídající dvěma částem škály a třetí faktor tvořený 4 položkami části PARS-PRE, které se zaměřují na časné čtení a počítání. Diagnostická přesnost dvou hlavních faktorů je srovnatelně nízká (r_{PRE} = .33, r_{CUR} = .25), výrazně vyšší je u třetího faktoru (r_{LIT} = .52). Dá se říci, že obecně je rodičovské hodnocení více založeno na verbálních schopnostech dítěte než na těch neverbálních. S ohledem na nízkou kriteriální validitu nelze doporučit škálu PARS pro využívání v praxi, závěry mohou být nicméně užitečné při vývoji podobně zaměřených nástrojů v budoucnu.
Limity. Baterie WJ IE II COG byla administrována pouze 90 dětem – takto malý vzorek ovlivnil přesnost odhadu parametrů. Do rodičovského hodnocení škálou PARS se zapojily pouze matky.