Studying Self-Awareness in Children: Validation of the Questionnaire of Executive Functioning (QEF)

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Abstract

*Objective:* People with accurate representations of their own cognitive functioning (i.e., cognitive self-awareness) tend to use appropriate strategies to regulate their behavior. Due to the lack of appropriate instruments, few studies have examined the development of this ability among children.

*Method:* This study tested the measurement properties of the self-rating and other-rating forms of the Questionnaire of Executive Functioning (QEF), designed to tap children’s knowledge of their executive functioning. Specifically, the construct, convergent, and discriminant validities were investigated and a self-other discrepancy score was computed to assess children’s executive self-awareness. Participants were 317 children aged 7 to 14 years old.

*Results:* Confirmatory factor analyses carried out on the QEF confirmed the eight-factor structure of both versions. There were significant correlations between the QEF and the parent versions of the Behavior Rating Inventory of Executive Function, the Dysexecutive Questionnaire for Children, and the Childhood Executive Functioning Inventory. Both forms of the QEF were able to distinguish between children who had sustained a traumatic brain injury (TBI) and control participants. A statistical difference was observed between the TBI and control groups on this score, suggesting that TBI may trigger self-awareness impairments in children.

*Conclusion:* The good psychometric properties of the two forms of the QEF were established. Furthermore, results of the analyses carried out on the different discrepancy scores seem to indicate that the QEF could help clinicians to detect patients with self-awareness deficits.

*Keywords:* Self-awareness; Executive functions; Psychometric properties; Children

Studying Self-Awareness in Children: Validation of the Questionnaire of Executive Functioning (QEF)

Cognitive self-awareness is typically defined as the ability to perceive and understand one’s own cognitive strengths and limitations (Flavell, 1979; Kennedy & Coelho, 2005; Morris & Mograbi, 2013; Toglia & Kirk, 2000). Generally, people with an accurate representation of their own cognitive functioning are expected to be more likely to make use of appropriate strategies to regulate their cognitive activities in daily life (Ownsworth, McFarland, & Young, 2002), resulting in better cognitive performance (Schneider, 2008). Self-awareness is usually evaluated by comparing participants’ ratings of their cognitive skills to an external/objective standard, such as a family member’s or clinician’s ratings or the participant’s performance on neuropsychological tests. The discrepancy score between the self-rating and the standard is classically used as an index of the level of self-awareness (Allen & Ruff, 1990; Fleming, Strong, & Ashton, 1996; Ranseen, Bohaska, & Schmitt, 1990; Sherer, Bergloff, Boake, High, & Levin, 1998).

Many instruments have been constructed to appraise adults’ self-awareness abilities in various cognitive, behavioral, and affective domains. For example, the Dysexecutive Questionnaire (DEX; Wilson, Alderman, Burgess, Emslie, & Evans, 1996) assesses participants’ knowledge of their own executive functioning. (Executive functions are operationalized as domain-general control processes that include the ability to inhibit, shift, organize, and monitor other cognitive processes; Archibald & Kerns, 1999.) The Comprehensive Assessment of Prospective Memory scale (CAPM; Chau, Lee, Fleming, Roche, & Shum, 2007) evaluates the accuracy with which people judge the frequency of their prospective memory problems; and the Awareness Questionnaire (AQ; Sherer et al., 1998) appraises patients’ awareness of their cognitive, behavioral and sensorimotor limitations. Each of these instruments allows practitioners to compute an index of self-awareness by comparing participants’ ratings of their cognitive skills to family member’s or clinician’s ratings.

However, although numerous instruments are available to assess adults’ cognitive self-awareness, only a limited number of tools have been developed to assess children’s knowledge of their own cognitive functioning. In addition, the few questionnaires available for children generally have poor (or not fully investigated) psychometric properties. For instance, the six-factor model of the Subjective Awareness of Neuropsychological Deficits Questionnaire for Children (SAND-C; Hufford & Fastenau, 2005) – a questionnaire assessing children’s knowledge of their attentional, psychomotor, visuospatial, language, memory, and executive functioning – is only weakly supported by the confirmatory factor analysis. Similarly, the psychometric properties of the junior version of the Metacognitive Awareness Inventory (MAI Jr; Sperling, Howard, Miller, & Murphy, 2002) – a questionnaire assessing children’s knowledge of general cognitive functioning – have not been fully investigated. Moreover, these two questionnaires only come in a self-rating form, making it difficult to compare children’s self-assessment of their cognitive abilities with an external quantitative standard. In addition, to our knowledge, neither of these questionnaires is designed to evaluate the cognitive self-awareness of children under the age of 9. Two questionnaires assessing children’s executive functioning (i.e., The Behavior Rating Inventory of Executive Function [BRIEF] and the Comprehensive Executive Function Inventory [CEFI]) come in both a self-rating and an other-rating form, but the self-report measures are not appropriate for children younger than 11 and 12 years, respectively. Moreover, no self-awareness indexes are available for these scales (Naglieri & Goldstein, 2012; Wilson Donders, & Nguyen, 2011).

From a theoretical point of view, the absence of validated, age-adapted instruments may explain why the developmental trajectory of children’s self-awareness abilities has attracted very little attention so far. To date, the limited available data seem to indicate that self-awareness improves significantly during childhood – particularly between the ages of 6 and 11 – and continues to develop more subtly throughout adolescence and adulthood (Fritz, Howie, & Kleitman, 2010; Kreutzer, Leonard, & Flavell 1975; Pressley & Schneider, 1997).

However, a better understanding of the development of children’s knowledge of their own cognitive functioning could have important implications on both theoretical and practical grounds. Several studies in adults have demonstrated that high self-awareness is related to the implementation of appropriate strategies, which is shown to improve people’s cognitive performance (e.g., Ownsworth et al., 2002; Toglia & Kirk, 2000). From a more clinical perspective, many authors have established that impaired self-awareness is commonly demonstrated following acquired brain injury in adults (Bivona et al., 2008; Bogod, Mateer, & Macdonald, 2003; Ciurli et al., 2010; Morton & Barker, 2010), reducing patients’ motivation to undergo rehabilitation (Malec & Moessner, 2000), interfering with safe and independent functioning (Flashman, 2002), and leading to poor employment outcomes and social integration problems (Trudel, Tryon, & Purdum, 1998). In this context, the construction and validation of an age-adapted instrument assessing children’s self-awareness would provide a useful tool to further investigate at what age people develop accurate knowledge of their own cognitive functioning and what variables are involved in this development. Furthermore, such an instrument would also allow researchers to examine how executive awareness is related to children’s educational performance and social integration.

However, as all the questionnaires of self-awareness that tapped multiple aspects of children’s cognition demonstrated poor reliability (Hufford & Fastenau, 2005; Sperling et al., 2002), we chose to focus on a specific domain of children’s cognitive functioning, but a major one. Specifically, our questionnaire was constructed to assess participants’ knowledge of their own executive abilities. Impaired executive functioning is frequently reported as a consequence of numerous neurological disorders that are common among children (e.g., epilepsy, hydrocephalus; Burmeister et al., 2005; Hernandez et al., 2002). For instance, executive problems are frequently reported following traumatic brain injury (TBI) in children and are shown to mediate the neurobehavioral sequelae that these patients exhibit (Levin & Hanten, 2005). Furthermore, deficits affecting executive functions are also likely to negatively impact children’s academic and psychosocial functioning (Mangeot, Armstrong, Colvin, Yeates, & Taylor, 2002).

For these reasons, self-rating and other-rating forms of a questionnaire assessing children’s executive functioning (QEF) were constructed. Specifically, the questionnaire was designed to assess eight executive processes classically included in the evaluation of adults’ and children’s day-to-day executive functioning: attention/concentration, working memory, self-monitoring, theory of mind, impulsivity/inhibition, shifting, planning/initiation, and emotional regulation (e.g., Baron, 2007, 2000; Bennett, Ong, & Ponsford, 2005; Simblett & Bateman, 2010). The first goal of this research is to examine the psychometric properties of the two versions of this new questionnaire. Specifically, we investigated the internal consistency, construct validity, and convergent validity of the QEF. We also examined whether the two forms of the new self-awareness questionnaire were able to discriminate between patients and control participants. As stated above, executive deficits are frequently reported following a TBI (e.g., Levin & Hanten, 2005). Accordingly, a group of children with moderate to severe TBI was included in the study so that we could test the QEF’s discriminant validity.

Finally, we explored the developmental and clinical discriminant validity of the self-awareness index. According to the literature, children’s metacognitive abilities are commonly supposed to improve with age. Furthermore, this improvement was recently shown to depend on executive functioning in both a sample of typically developing children (Geurten, Catale, & Meulemans, 2016) and a sample of children who had sustained a TBI (Geurten, Chevignard, Kerrouche, Tiberghien, & Meulemans, 2015). For these reasons, we examined whether the self-other discrepancy score is influenced by children’s age. Similarly, we investigated whether statistical differences could be found between patients and control participants on this self-awareness measure.

**Methods**

**Participants**

**Control group.** A total of 317 typically developing children and adolescents whose ages ranged from 7 to 14 years (Mean = 8.98 years, SD = 1.91) participated in the study. Seven years was chosen as the cutoff age because this is the earliest age at which children are able to read the items of the questionnaire without needing much external help. Fifty-four percent of the subjects were girls. The mean of both parents’ years of education was used to appraise socioeconomic status (Mean = 13.62, SD = 2.48). Sixty-six additional participants were recruited but not included in the final analyses because they did not respond to all the items of the questionnaire or because their parents did not return their version of the questionnaire. Exclusion criteria for participation in this sample were a history of acquired brain injury or neurological, developmental, learning, or psychiatric disorders. The sample was recruited from French-speaking kindergartens and elementary schools in the province of Liège, Belgium.

**Patient group.** A group of 29 French-speaking children (12 females) who had sustained moderate (n = 10) to severe TBI (n = 19) from closed head trauma participated in the study. They were recruited from the University Hospital (n = 9), the Regional Hospital (n = 6), and the Psychological and Speech Therapy Consultation Center (n = 3) in Liège, Belgium, the William-Lennox Healthcare Center (n = 6) in Brussels, Belgium, and the Saint-Maurice Hospitals (n = 5) in Saint-Maurice, France. All of them were between 7 and 14 years of age at the time of assessment. Half the patients (n = 14) were included in a rehabilitation program when they completed the questionnaire. Injury severity was determined by the Glasgow Coma Scale score (GCS; Teasdale & Jennett, 1974) on admission (severe ≤ 8; moderate > 8 and < 13) or by the duration of unconsciousness (severe > 6 hours; moderate < 6 hours and > 1 hour). Exclusion criteria are a history of psychiatric disorder, an established diagnosis of developmental disability or mental deficiency, and a pre-trauma history of neurological disorder. Each of these patients was matched as closely as possible with a control participant for age, *t*(56) = 0.04, *p* = .96, and parental education level, *t*(56) = 0.17, *p* = .86. Demographic and clinical data on the patients and their matching controls are displayed in Table 1.

< Table 1 >

**Materials and Procedure**

Both patients and control children were enrolled following written informed consent from their parents and with the agreement of the ethics committees of the participating institutions. Control children completed the questionnaire individually in a quiet room at their school. Patients completed the questionnaire at home (n = 18) or in the institution where they were recruited (n = 11). Participants under the age of 9 were instructed to read the statements aloud so that the experimenter could help them to read the items and could define the words they did not know. Both young and older participants were invited to ask for help from the experimenter when they did not understand an item. All children were given the French version of the self-assessment form of the QEF. The parents (i.e., the mother in 83% of the cases) were given the French version of the hetero-assessment form of the QEF, a brief amnestic questionnaire, and three validated executive dysfunction questionnaires. They completed them at home. We chose parents instead of clinicians as other raters because we expected them to be in the best position to judge their children’s executive abilities in daily life.

**Questionnaire of Executive Functioning (QEF).** A first version of the questionnaire was constructed by two experienced neuropsychologists (MG and CC) who specialize in children’s executive and awareness impairments. The principal goal of the questionnaire was to provide specific examples of executive problems in daily living. The items were formulated to be easy for children to understand and to investigate specific executive processes. The first version of the questionnaire was composed of 38 items and included eight a priori scales. We distributed the questionnaire to three experts in the field of clinical neuropsychology for critical review. They were asked to judge the developmental appropriateness of the items, the adequacy of the survey response choices, and the understandable nature of the instructions. Finally, they were given the names of the eight subscales of the questionnaire and were asked to blindly decide which subscale each item belonged to. Cohen’s kappa correlations (interrater reliability) for the different subscales ranged from .79 to .93, which suggested substantial to almost perfect agreement. Following this face validity step, the a priori structure of the questionnaire was confirmed overall. However, the wording of some statements was adjusted and two items were deleted because the experts judged them to be too difficult for young children’s reading abilities. All the words composing the items of the self-rating form of the questionnaire were selected to be included in the vocabulary of 7-year-old children. The reading level of the QEF is around a second or a third grade level.

The final version of the QEF comes in both a self-rating and an other-rating form and contains 36 easily understandable items that are rated on a 4-point Likert scale indicating the frequency of occurrence ranging from 1 (“not at all”) to 4 (“very often”). The questionnaire was divided into eight a priori subscales: namely, attention/concentration (5 items), working memory (4 items), self-monitoring (5 items), theory of mind (4 items), shifting (3 items), impulsivity/hyperactivity (5 items), planning/initiation (4 items), and emotional regulation (5 items). At present, the questionnaire is available in French and English. (See the Appendix for the French version of the QEF. The English translation of the questionnaire is provided as supplementary material.) We would like to note that the English translation of the QEF has not yet been validated.

Moreover, the primary aim of the present study was to create and validate an instrument assessing children’s executive awareness. Thus, a self-awareness score was calculated. In accordance with previous studies (e.g., Fleming et al., 1996; Sherer, Hart, & Nick, 2003; Smith & Arnett, 2010), participants’ level of awareness was computed by subtracting others’ ratings from children’s ratings to produce a self-other discrepancy score (–108 to +108). A negative score indicated that children rated themselves better than their parents rated them.

**Executive dysfunction questionnaires.** Three validated questionnaires assessing executive dysfunctions that are commonly used by clinicians in child neuropsychology were also completed by parents: the French versions of (a) the Childhood Executive Functioning Inventory (CHEXI; Catale, Meulemans, & Thorell, 2013); (b) the Dysexecutive Questionnaire for Children (DEX-C; Baron, 2007); and (c) the Behavior Rating Inventory of Executive Function (BRIEF; Baron, 2000). The CHEXI includes 26 items divided into two subscales, which assess the frequency of working memory and inhibition problems, respectively. The DEX-C includes 20 items and provides a global score of executive dysfunction. Finally, the BRIEF includes 86 items, constituting eight clinical scales (inhibit, shift, emotional control, initiate, working memory, plan/organize, organization of materials, monitor). All of these questionnaires are based on hetero-assessment.

**Data Analyses**

Statistical analyses were done using *Mplus* software version 7.31 (Muthén & Muthén, 2007) and *Statistica* software version 10 (Hill & Lewicki, 2007). The first goal of our study was to examine the psychometric properties of the QEF. For this purpose, exploratory factor analyses (EFAs) were first conducted for each form of the QEF. Then, the eight-factor structure of the self-rating and other-rating forms of the instrument was investigated using confirmatory factor analyses (CFAs). The CFAs were carried out only for the control sample. These analyses were first conducted for the whole control sample, then separately for the younger and older children in the control group. This procedure was employed because 7- to 9-year-old children were more likely than older children to experience difficulty when completing the questionnaire and, thus, to demonstrate inconsistent results. Maximum likelihood parameter estimates with standard errors and a mean-adjusted chi-square test were used as estimation procedures. Several goodness-of-fit indices were used to evaluate the model’s acceptability: the chi-square divided by degrees of freedom (χ²/df), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). To indicate an adequate fit, the χ²/df ratio had to be less than 2, the RMSEA .08 or lower, the CFI higher than .95, and the SRMR not above .10 (Brown, 2006). Once the factor structure was supported, internal reliability was inspected using McDonald’s omega (an alternative to Cronbach’s alpha; Stone et al., 2013). To do so, we used the psych package available from CRAN (Comprehensive R Archive Network: http://www.R-project.org). We then carried out analyses of covariance (ANCOVAs) to examine whether the two forms of the QEF were sensitive to age and gender differences. Furthermore, ANOVAs and Receiver Operating Characteristic (ROC) curve analyses were used to assess the QEF’s ability to discriminate between patients with moderate to severe TBI and control participants. Finally, correlation analyses between scores on the QEF and on the CHEXI, DEX-C, and BRIEF were carried out to check the convergent validity of the two versions of the questionnaire.

Once the good psychometric properties of the self-rating and other-rating forms of the QEF were established, we examined the developmental and clinical sensitivity of the self-awareness measure (i.e., the discrepancy score between the self-rating and other-rating forms of the questionnaire). To this end, one-way ANOVAs were used to compare the patients’ discrepancy scores with those of their matched controls.

**Results**

**Exploratory Factor Analyses**

All items in the two forms of the QEF were included in two EFAs (principal components). For the other-rating form, eight factors emerged with an eigenvalue exceeding 1, explaining a total of 55.88% of the variance. Similarly, for the self-rating form, eight factors emerged with an eigenvalue exceeding 1, explaining a total of 43.91% of the variance (details of the eigenvalues are provided in the supplemental results section).

**Confirmatory Factor Analyses**

**Other-rating form.** Given the results of the EFA, the hypothesized eight-factor model of the other-rating form of the questionnaire was examined with CFA. Standardized factor loadings for items are summarized in Table 2 (percentage of variance explained for items are provided in the supplemental results section). The results yielded a χ²/df ratio = 1.91, RMSEA = .06, CFI = .95, and SRMR = .09. All of these indices showed an acceptable fit for the model tested. In addition, the developmental stability of the factor structure was investigated. Specifically, separate CFAs were conducted with the younger (n = 143; from 7 to 9 years old) and older (n = 174; from 10 to 14 years old) children in the sample. The results showed a χ²/df ratio = 1.43, RMSEA = .06, CFI = .78, and SRMR = .04 for the younger group, and a χ²/df ratio = 1.52, RMSEA = .05, CFI = .95, and SRMR = .09 for the older group. Except for the CFI for the youngest children, all of these indexes showed an acceptable fit for the model tested.

**Self-rating form.** The method used to analyze the other-rating form of the QEF was also employed to confirm the factor structure of the self-rating version. The results revealed a χ²/df ratio = 1.55, RMSEA = .04, CFI = .96, and SRMR = .08, indicating a good fit. Furthermore, the separate CFAs carried out with the younger and older children in our sample yielded a χ²/df ratio = 1.22, RMSEA = .04, CFI = .95, and SRMR = .09 for the younger group, and a χ²/df ratio = 1.40, RMSEA = .05, CFI = .95, and SRMR = .10 for the older group. Once again, each of these indexes revealed an acceptable fit for the eight-factor model.

< Table 2 >

**Internal Consistency Reliability**

**Other-rating form.** The reliability coefficient (McDonald’s omega; Dunn, Baguley, & Brunsden, 2014; McDonald, 1999) was .97 for the whole questionnaire, indicating very good reliability. The coefficient revealed acceptable internal consistency for the attention/concentration (*ω* = .82), working memory (*ω* = .79), self-monitoring (*ω* = .82), theory of mind (*ω* = .79), shifting (*ω* = .73), impulsivity/inhibition (*ω* = .83), planning/initiation (*ω* = .79), and emotional regulation (*ω* = .86) subscales.

**Self-rating form.** The reliability coefficient indicated acceptable internal consistency for the attention/concentration (*ω* = .82), working memory (*ω* = .78), self-monitoring (*ω* = .83), theory of mind (*ω* = .80), shifting (*ω* = .73), planning/initiation (*ω* = .78), impulsivity/inhibition (*ω* = .82), and emotional regulation (*ω* = .85) subscales. The McDonald’s ω was .97 for the total self-rating score.

**Sensitivity/Specificity**

**Other-rating form.**

***Developmental sensitivity.*** ANCOVAs were conducted to examine age and gender effects on each of the subscales of the QEF (see means in Table 3). For this purpose, children’s age (in months) was included as a covariate in the following analyses. The results indicated no gender effect for any of the subscales or for the total scale, all *Fs* < 4. However, a significant effect of age was found for the total scale, *F*(1, 314) = 14.53, *p* < .001, η²p = .04; the attention/concentration subscale, *F*(1, 314) = 6.09, *p* = .014, η²p = .02; the working memory subscale, *F*(1, 314) = 6.56, *p* = .011, η²p = .02; the self-monitoring subscale, *F*(1, 314) = 9.50, *p* = .002, η²p = .03; the theory of mind subscale, *F*(1, 314) = 6.48, *p* = .011, η²p = .02; and the impulsivity/inhibition subscale, *F*(1, 314) = 8.70, *p* = .003, η²p = .03. No other significant result was found, Fs < 3.10. On the whole, these results revealed the questionnaire’s good developmental sensitivity. Specifically, parents of older children reported that their children had better executive efficiency than parents of younger children.

< Table 3 >

***Clinical sensitivity/specificity.*** First, the ability of the different subscales of the other-rating version of the QEF to discriminate between patients who had sustained moderate to severe TBI and control participants matched for age and parental education level was explored. The results showed significant differences between groups for the total scale (M = 82.41 vs. 59.59 for the TBI and the control group, respectively), *F*(1,56) = 44.55, *p* < .001, η²p = .44, as well as for each of its eight factors; namely, the attention/concentration factor (M = 13.72 vs. 9.14), *F*(1,56) = 60.30, *p* < .001, η²p = .52; the working memory factor (M = 10.38 vs. 6.31), *F*(1,56) = 35.28, *p* < .001, η²p = .39; the self-monitoring factor (M = 12.79 vs. 10.93), *F*(1,56) = 4.73, *p* = .034, η²p = .08; the theory of mind factor (M = 8.41 vs. 7.10), *F*(1,56) = 5.41, *p* = .024, η²p = .09; the shifting factor (M = 6.72 vs. 4.83), *F*(1,56) = 21.18, *p* < .001, η²p = .27; the impulsivity/inhibition factor (M = 12.38 vs. 8.52), *F*(1,56) = 20.67, *p* < .001, η²p = .27; the planning/initiation factor (M = 8.62 vs. 5.90), *F*(1,56) = 18.74, *p* < .001, η²p = .25; and the emotional regulation factor (M = 9.38 vs. 6.86), *F*(1,56) = 12.92, *p* < .001, η²p = .19.

In addition, the ROC curve method was used to further investigate the discriminant validity of the other-rating form of the QEF. Conventionally, the area under the ROC curve would be 1.0 for a measure that discriminates perfectly between patients and controls, and .50 for a measure that discriminates with an accuracy no better than chance. An area under the ROC curve higher than .70 indicates adequate discrimination. The ROC curves are displayed in Figure 1. The results revealed that the area under the ROC curve was .89 for the total questionnaire score and ranged from .67 (self-monitoring) to .92 (attention/concentration) for the subscales. The positive predictive values (PPV; i.e., the proportion of people with a positive test result who actually have TBI) and the negative predictive values (NPV; i.e., the proportion of people with a negative test result who do not have TBI) for the best cutoff scores are presented in Table 4.

< Table 4 >

< Figure 1 >

**Self-rating form.**

***Developmental sensitivity.***Once again, ANCOVAs were carried out to examine age and gender effects on each of the factors of the self-rating form of the QEF. The results revealed no gender effect, Fs < 3.30. On the other hand, an age effect was found for the total scale, *F*(1, 314) = 6.85, *p* = .009, η²p = .02; the working memory factor, *F*(1, 314) = 23.67, *p* < .001, η²p = .07; the self-monitoring factor, *F*(1, 314) = 8.56, *p* = .003, η²p = .03; the theory of mind factor, *F*(1, 314) = 15.03, *p* < .001, η²p = .05; and the planning/initiation factor, *F*(1, 314) = 50.74, *p* < .001, η²p = .14. No other results reached significance, *Fs* < 1.18. These results indicated the questionnaire’s good developmental sensitivity. Specifically, older children reported better executive efficiency than younger children.

***Clinical sensitivity/specificity.*** Statistical differences were found between the patients and their matched controls for the total score of the self-rating version of the QEF (M = 76.79 vs. 67.54 for the TBI and control groups, respectively), *F*(1,56) = 7.58, *p* = .008, η²p = .13; the attention/concentration subscale (M = 12.25 vs. 10.14), *F*(1,56) = 8.06, *p* = .006, η²p = .14; and the theory of mind subscale (M = 9.04 vs. 6.46), *F*(1,56) = 11.73, *p* = .001, η²p = .19. Furthermore, a trend toward a significant group effect was found for the self-monitoring subscale (M = 12.33 vs. 10.93), *F*(1,56) = 3.61, *p* = .067, η²p = .07. No other results reached significance, all *Fs* < 2.36.

The results of the ROC curve method (see Figure 2) indicated that the area under the ROC curve was .70 for the total score of the self-rating form of the QEF and ranged from .50 (planning/initiation) to .75 (theory of mind) for the subscales. The PPV and NPV for the best cutoff scores are presented in Table 5.

< Figure 2 >

< Table 4 >

**Convergent Validity**

**Other-rating form.** To investigate the convergent validity of the other-rating form of the questionnaire, partial correlation analyses were conducted between each of the subscales of the QEF and each of the factors of the CHEXI, the DEX-C, and the BRIEF. As Table 6 reveals, when the influence of chronological age (in months) was taken into account, significant correlations were highlighted between each factor of the QEF and the factors of the other three executive dysfunction questionnaires. Interestingly, the largest correlations for the working memory factor of the QEF were found with the working memory factors of the CHEXI (*rp* = .75, *p*<.001) and the BRIEF (*rp* = .65, *p*<.001). The largest correlations for the emotional regulation factor and the self-monitoring factor of the QEF were found with the emotional control factor (*rp* = .61, *p*<.001) and the monitoring factor of the BRIEF (*rp* = .55, *p*<.001), respectively. Similarly, the largest correlation for the planning/initiation factor of the QEF was found with the planning (*rp* = .64, *p*<.001) and initiation (*rp* = .66, *p*<.001) factors of the BRIEF. On the whole, these results indicate the good convergent validity of the hetero-assessment version of the questionnaire.

**Self-rating form.** As revealed in Table 6, significant partial correlations were found between the total score for the self-rating form of the QEF and the three executive dysfunction questionnaires. Moreover, the working memory factor of the QEF correlated only with the working memory factors of the CHEXI (*rp* = .27, *p* = .01) and the BRIEF (*rp* = .24, *p* = .02). The impulsivity/inhibition factor showed the largest correlations with the inhibition factors of both the CHEXI (*rp* = .24, *p* = .03) and the BRIEF (*rp* = .28, *p* = .01). Furthermore, the largest correlations for the QEF’s shifting factor and emotional regulation factor were found with the shifting factor (*rp* = .22, *p* = .04) and the emotional control factor (*rp* = .25, *p* = .02) of the BRIEF, respectively. In sum, these findings seem to demonstrate the relatively acceptable convergent validity for most subscales of the self-assessment version of the QEF.

< Table 6 >

**Discrepancy Measure**

Once the psychometric properties of the two forms of the QEF were examined, correlation analyses were conducted to investigate relationships between them. Our results indicated significant correlations between the different subscales of the other-rating form of the QEF and their equivalents in the self-rating form of the questionnaire (see Table 7). In this context, we computed QEF self-awareness indexes (i.e., the discrepancy between the self-rating and other-rating scores for each subscale of the QEF), then examined the discriminant validity of these different indexes. We first investigated this measure’s developmental sensitivity. To do this, an ANCOVA was conducted to examine the effects of age and gender on children’s executive self-awareness. No significant gender effect was found, all *Fs* < 1.58. However, the results revealed a trend toward an influence of chronological age on children’s self-awareness index for the whole scale, *F*(1,248) = 3.18, *p* = .076, η²p = .01. A significant effect of age was found for the attention/concentration factor, *F*(1,248) = 8.54, *p* = .003, η²p = .03, and the impulsivity/inhibition factor, *F*(1,248) = 5.79, *p* = .016, η²p = .02. These findings indicated that younger children rated themselves better on these specific factors than their parents did, while older children seemed to rate themselves worse than their parents did.

Secondly, a one-way ANOVA was carried out to explore the self-awareness measures’ ability to discriminate between patients who had sustained TBI and control participants matched for age and parental education level. The results indicated a significant difference between the two groups for the total scale, *F*(1,56) = 15.97, *p* < .001, η²p = .24; the attention/concentration factor, *F*(1,56) = 8.71, *p* = .007, η²p = .28; the working memory factor, *F*(1,56) = 19.99, *p* < .001, η²p = .48; the shifting factor, *F*(1,56) = 9.71, *p* = .005, η²p = .31; the impulsivity/inhibition factor, *F*(1,56) = 5.49, *p* = .028, η²p = .20; and the planning/initiation factor, *F*(1,56) = 15.81, *p* < .001, η²p = .42. Specifically, the patient group rated themselves better than their parents did (*M* = –6.42; SD = 16.37). On the other hand, the control group rated themselves worse than their parents did (*M* = 8.39; SD = 10.01).

<Table 7>

**Discussion**

The main goal of this study was to construct and validate a new instrument to assess children’s knowledge of their own cognitive functioning in everyday life. To do this, we first created self-rating and other-rating forms of a questionnaire designed to assess the executive functioning of children aged between 7 and 14 years old. Then, we examined the psychometric properties of these two questionnaires. The items of both versions of the questionnaire were constructed according to the following eight dimensions: attention/concentration, working memory, self-monitoring, theory of mind, shifting, impulsivity/inhibition, planning/initiation, and emotional regulation. On the whole, our results indicate good construct and discriminant validity as well as good internal reliability for the two questionnaires. Mixed results are found for the convergent validity. Globally, however, our findings suggest that the QEF is a valid instrument for evaluating both the frequency of children’s executive difficulties in daily life and their self-awareness abilities.

More specifically, the eight-factor structure of the two versions of the questionnaire was demonstrated statistically and the developmental stability of this factor model was confirmed. Except for the CFI of the other-rating form of the QEF for young children, all indexes of the other-rating and self-rating form revealed adequate fit for both young and older children. As the CFI depends in large part on the average size of the correlations in the data, this result suggests that parents of young children give less consistent responses between items than parents of older children. This pattern may be due to the fact that some executive abilities assessed by the QEF are still immature in young children while others are already well developed, leading parents to report better or poorer executive efficiency depending on the items and thus reducing the size of the correlations in the data. Conversely, the development of older children’s executive skills is probably already good (although not perfect) in most executive domains (see Best & Miller, 2010), increasing the consistency of the parents’ ratings between items. Nevertheless, the results of the statistical analyses indicated acceptable internal reliability for the different subscales constituting both forms of the QEF. Overall, these results confirm the new questionnaire’s psychometric robustness.

With regard to convergent validity, the large correlations observed between the *hetero-assessment* version of the QEF and the other executive dysfunction questionnaires indicate that the QEF assesses the same theoretical constructs as the BRIEF, the DEX-C, and the CHEXI. In this context, our questionnaire appears to be a good compromise between the rapid screening scales (e.g., the DEX-C) and the comprehensive but time-consuming questionnaires (e.g., the BRIEF or the CEFI) that are currently available. To our knowledge, the QEF is the first validated questionnaire on children’s executive dysfunction that comes in both a self-rating and an other-rating form (the BRIEF and the CEFI also come in both a self-rating and an other-rating form but are not appropriate for children younger than 11 years). On the other hand, the convergent validity of the self-rating form of the QEF appears to be poorer than the convergent validity of the other-rating form. However, each of the three executive scales used to appraise convergent validity was a hetero-assessment scale. The fact that other-rating and self-rating reports were compared could have logically reduced the size of the correlations between the questionnaires. To address this issue, a further investigation of the convergent validity of the self-rating form of the QEF should be conducted. As no self-assessment forms of executive questionnaires are available under the age of 11 (e.g., BRIEF), the convergent validity of the QEF can only be re-examined in older children (this has not been done in the present study). Moreover, the fact that the size of the correlations between the *self-assessment* version of the QEF and the three *hetero-assessment* versions of the other executive questionnaires is only moderate at best suggests that the self-evaluation form of the questionnaire delivers information about children’s day-to-day executive functioning that complements the more classical hetero-evaluation questionnaires. Thus, the self-rating version of the QEF should probably be used by practitioners in addition to the family member’s rating version. It could provide them with additional information about the nature of their patients’ executive problems, which may constitute a good starting point for the rehabilitation process.

Regarding the QEF’s sensitivity, no gender effect was found. However, a significant effect of age was revealed for several factors of the other-rating (i.e., attention/concentration, working memory, self-monitoring, theory of mind, and impulsivity/inhibition) and self-rating (i.e., working memory, self-monitoring, theory of mind and planning/initiation) versions of the questionnaire. Specifically, consistent with studies examining the developmental sensitivity of other inventories of children’s executive dysfunction (e.g., Baron, 2000), we demonstrated that older children (and their parents) reported fewer executive difficulties than younger children (and their parents). Given that executive functions are usually found to improve with age (for a review, see Best & Miller, 2010), this finding may suggest that a higher level of executive functioning reduces the frequency of participants’ executive complaints in daily life. Nonetheless, other studies should be carried out to confirm this hypothesis and investigate whether the effect of age on subjective reports of executive difficulties is truly mediated by improvements in objective measures of executive functioning.

Another aim of this study was to examine the questionnaire’s discriminant power, namely its ability to distinguish between children with TBI and their matched controls. Comparisons revealed significant differences between the two groups on the self-rating and other-rating forms of the questionnaire. Furthermore, ROC analyses revealed a good level of specificity and sensitivity, particularly for the other-rating version of the questionnaire. Interestingly, it also appears that some factors of the QEF discriminate better than others between children with TBI and their matched controls (e.g., working memory, self-monitoring, and theory of mind subscales). As the factors that discriminate between children with TBI and controls differ from those that discriminate between younger and older children, this pattern does not seem to result from a general lack of sensitivity of the questionnaire. On the contrary, our results suggest that some executive problems are more frequently reported than others following a TBI. Replication of these findings in a larger sample of children with TBI should, of course, be conducted to confirm this observation. Nonetheless, our findings provide preliminary evidence that the QEF may be a useful tool to screen for executive difficulties in children with TBI.

Finally, once the psychometric properties of the two versions of the QEF were established, we computed a discrepancy score between the self-rating and other-rating forms of the questionnaire to examine the sensitivity of the self-awareness measure. Interestingly, our results indicate that children who had sustained a TBI rated their executive problems as occurring less often than their parents reported, while typically developing children seemed to rate themselves worse than their parents did. These findings are consistent with several studies in adults demonstrating that patients with TBI frequently underestimate the frequency of their cognitive problems (e.g., Bivona et al., 2008; Bogod et al., 2003; Ciurli et al., 2010; Morton & Barker, 2010). However, although a number of researchers used the self-other discrepancy method to appraise self-awareness abilities in adults, we should keep in mind that what a relative reports is not necessarily an accurate picture of the participant’s cognitive functioning. Family members’ perceptions may be as biased as the patient’s (Fleming et al., 1996). In this context, to obtain a reliable information about a participant’s performance, several respondents who interact with this participant in different contexts should be invited to complete the questionnaire. Regarding the QEF, a teacher version could be developed. Indeed, teachers’ point of view could be very informative regarding executive functioning deficits, as school is where these difficulties are typically seen.

In conclusion, the analysis of the psychometric properties of the new questionnaire indicates that the QEF is a reliable instrument for appraising the frequency of executive difficulties in daily life. Furthermore, because this questionnaire comes in both a self-rating and an other-rating form, it allows us to compute a score of self-awareness. To date, no other validated instrument is available to assess French-speaking children’s knowledge of their own cognitive functioning. Although the QEF has some limitations (e.g., no items controlling for consistency of rating or over-reporting of problems were included) and although other investigations should be conducted to further examine some aspects of its psychometric properties (e.g., the test-retest reliability and convergent validity of the self-rating form of the questionnaire), the QEF will certainly be a useful tool to further study the developmental trajectory of children’s cognitive self-awareness. From a clinical perspective, the QEF could also help clinicians to detect patients with self-awareness deficits who are likely, as a result, to be less motivated to take part in rehabilitation programs.

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**Appendix**

French Version of the Other-Rating Form of the QEF

|  |
| --- |
| 1. A des difficultés à rester concentrer sur ses devoirs. |
| 2. Quand on lui dit d’aller chercher plusieurs choses, il n’arrive pas à tout retenir et il doit demander qu’on le lui répète. |
| 3. Quand il fait des choses qui peuvent embarrasser ou gêner quelqu’un, il s’en rend compte. |
| 4. Quand on le punit, il comprend ce qu’il a fait de mal. |
| 5. Reste concentré sans être distrait quand on le lui demande. |
| 6. N’aime pas quand on change ses habitudes (par exemple, se laver le matin alors qu’habituellement, il se lave le soir, manger autre chose que son petit déjeuner habituel etc.). |
| 7. Quand on lui demande de faire plusieurs choses (s’habiller, ou commencer ses devoirs, …), il ne sait pas par quoi commencer et on doit l’aider. |
| 8. Peut jouer longtemps avec le même jeu. |
| 9. N’arrive pas à retenir plusieurs consignes (par exemple, « Descends le linge et va chercher une boîte de lait et deux boîtes de biscuits »). |
| 10. Après un exercice, il relit plusieurs fois pour être sûr qu’il n’a pas fait d’erreur. |
| 11. A besoin de bouger (ses mains ou ses pieds) ou de se lever quand il est assis trop longtemps. |
| 12. Lorsqu’il fait une erreur, il s’en rend compte immédiatement. |
| 13. Quand il joue, il a du mal à arrêter ce qu’il est en train de faire. |
| 14. On doit lui répéter les choses car il les oublie tout de suite. |
| 15. Quand il doit choisir une seule activité parmi plusieurs qu’il aime faire (cinéma, cirque, manger une glace, …), il ne sait pas se décider. |
| 16. Lorsqu’un(e) de ses ami(e)s pleure ou a de la peine, il essaye de faire quelque chose pour le/la consoler. |
| 17. Quand il regarde la télévision, il s’agite sur le canapé ou il se lève. |
| 18. Quand on lui demande de faire quelque chose, il réfléchit à « *comment* » il va faire avant de commencer. |
| 19. A du mal à se calmer quand il est fâché (frappe, crie, etc.). |
| 20. Quand il fait ses devoirs, il est distrait(e) pas les bruits ou les personnes qui sont près de lui. |
| 21. Change d’humeur (par exemple, il rit et puis directement après, il pleure). |
| 22. Est très doué aux jeux où il y a beaucoup de règles à respecter car il les retient très bien au moment où il joue. |
| 23. Sait dire à l’avance s’il a bien ou mal fait un contrôle/une interrogation (exemple, lorsque il dit qu’il a très bien réussi son contrôle, il obtient effectivement une note de 8 ou 9 sur 10). |
| 24. Remarque vite quand il a fait quelque chose qui a fait de la peine à quelqu’un. |
| 25. A des difficultés pour s’empêcher de parler même lorsqu’il doit se taire. |
| 26. S’il est dérangé pendant une activité, après il ne sait plus reprendre ce qu’il était en train de faire. |
| 27. A besoin qu’on l’oblige à commencer ses devoirs et qu’on lui dise par quoi il doit commencer sinon il ne les ferait jamais. |
| 28. Ne sait pas ce qu’il doit mettre dans son cartable pour le lendemain. |
| 29. Prend beaucoup de temps pour s’habiller parce qu’il fait autre chose en même temps (se regarde dans le miroir ou chipote avec ses jeux, …). |
| 30. Se met très fort en colère si on l’embête. |
| 31. Si on lui demande de faire quelque chose qu’il n’a pas envie de faire, il crie ou pleure très fort pour ne pas le faire. |
| 32. Lorsqu’il s’habille, il repère très vite s’il a mis ses vêtements de travers ou à l’envers (exemple : boutons décalés, chaussette à l’envers, etc.). |
| 33. Pleure très fort dès qu’on l’ennuie. |
| 34. Au repas, il ne peut pas s’empêcher de se lever de table. |
| 35. Il lui arrive de se jeter à terre en criant quand il n’est pas content. |
| 36. Quand il a quelque chose à dire, il interrompt les gens qui parlent parce qu’il a envie de leur dire tout de suite. |

**Figure Captions**

**Figure 1.** ROC curves for the total score and each subscale score of the other-rating form of the QEF in discriminating between TBI and control groups*.*

**Figure 2.** ROC curves for the total score and each subscale score of the self-rating form of the QEF in discriminating between TBI and control groups*.*

Table 1

*Clinical and Demographic Data (Means and Standard Deviations) on the Whole Sample, the TBI Group and the Matched Control Group*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Whole Sample (n = 317) | TBI (n = 29) |  | Matched Control (n = 29) |  |
| Demographic |  |  | |  | |
| Sex (no. of females) | 172 | 12 | | 12 | |
| Age (months) | 107.74 (22.89) | 131.90 (29.87) | | 131.58 (30.06) | |
| Parental education level (years) | 13.62 (2.48) | 13.43 (2.26) | | 13.53 (2.25) | |
| Clinical |  |  | |  | |
| GCS |  | 9.83 (3.35) | |  | |
| Length of coma (days) |  | 3.79 (4.72) | |  | |
| Age at injury (months) |  | 114.42 (31.29) | |  | |
| Months since injury |  | 17.48 (16.16) | |  | |
| Type of injury (no. of participants) |  |  | |  | |
| RTA |  | 21 | |  | |
| Fall |  | 8 | |  | |

*Note.* TBI = Traumatic brain injury; GCS = Glasgow Coma Scale; RTA = Road traffic accident

Table 2

*Confirmatory Factor Analysis: Standardized Factor Loading for the Self-Rating and Other-Rating Forms of the QEF*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Items | OTHER | | | | | | | | SELF | | | | | | | |
| ATT | WM | SM | TOM | SHIFT | IMPU | PLAN | EMOR | ATT | WM | SM | TOM | SHIFT | IMPU | PLAN | EMOR |
| Item 1 | .86 | -- | -- | -- | -- | -- | -- | -- | .52 | -- | -- | -- | -- | -- | -- | -- |
| Item 2 | -- | .85 | -- | -- | -- | -- | -- | -- | -- | .61 | -- | -- | -- | -- | -- | -- |
| Item 3 | -- | -- | -- | .78 | -- | -- | -- | -- | -- | -- | -- | .66 | -- | -- | -- | -- |
| Item 4 | -- | -- | -- | .74 | -- | -- | -- | -- | -- | -- | -- | .62 | -- | -- | -- | -- |
| Item 5 | .55 | -- | -- | -- | -- | -- | -- | -- | .37 | -- | -- | -- | -- | -- | -- | -- |
| Item 6 | -- | -- | -- | -- | .28 | -- | -- | -- | -- | -- | -- | -- | .31 | -- | -- | -- |
| Item 7 | -- | -- | -- | -- | -- | -- | .88 | -- | -- | -- | -- | -- | -- | -- | .45 | -- |
| Item 8 | .32 | -- | -- | -- | -- | -- | -- | -- | .19 | -- | -- | -- | -- | -- | -- | -- |
| Item 9 | -- | .94 | -- | -- | -- | -- | -- | -- | -- | .72 | -- | -- | -- | -- | -- | -- |
| Item 10 | -- | -- | .66 | -- | -- | -- | -- | -- | -- | -- | .47 | -- | -- | -- | -- | -- |
| Item 11 | -- | -- | -- | -- | -- | .81 | -- | -- | -- | -- | -- | -- | -- | .31 | -- | -- |
| Item 12 | -- | -- | .76 | -- | -- | -- | -- | -- | -- | -- | .47 | -- | -- | -- | -- | -- |
| Item 13 | -- | -- | -- | -- | .39 | -- | -- | -- | -- | -- | -- | -- | .37 | -- | -- | -- |
| Item 14 | -- | .78 | -- | -- | -- | -- | -- | -- | -- | .71 | -- | -- | -- | -- | -- | -- |
| Item 15 | -- | -- | -- | -- | -- | -- | .40 | -- | -- | -- | -- | -- | -- | -- | .19 | -- |
| Item 16 | -- | -- | -- | .47 | -- | -- | -- | -- | -- | -- | -- | .65 | -- | -- | -- | -- |
| Item 17 | -- | -- | -- | -- | -- | .59 | -- | -- | -- | -- | -- | -- | -- | .43 | -- | -- |
| Item 18 | -- | -- | .37 | -- | -- | -- | -- | -- | -- | -- | .29 | -- | -- | -- | -- | -- |
| Item 19 | -- | -- | -- | -- | -- | -- | -- | .71 | -- | -- | -- | -- | -- | -- | -- | .47 |
| Item 20 | .80 | -- | -- | -- | -- | -- | -- | -- | .53 | -- | -- | -- | -- | -- | -- | -- |
| Item 21 | -- | -- | -- | -- | -- | -- | -- | .64 | -- | -- | -- | -- | -- | -- | -- | .51 |
| Item 22 | -- | .40 | -- | -- | -- | -- | -- | -- | -- | .27 | -- | -- | -- | -- | -- | -- |
| Item 23 | -- | -- | .66 | -- | -- | -- | -- | -- | -- | -- | .39 | -- | -- | -- | -- | -- |
| Item 24 | -- | -- | -- | .58 | -- | -- | -- | -- | -- | -- | -- | .71 | -- | -- | -- | -- |
| Item 25 | -- | -- | -- | -- | -- | .65 | -- | -- | -- | -- | -- | -- | -- | .59 | -- | -- |
| Item 26 | -- | -- | -- | -- | .68 | -- | -- | -- | -- | -- | -- | -- | .63 | -- | -- | -- |
| Item 27 | -- | -- | -- | -- | -- | -- | .58 | -- | -- | -- | -- | -- | -- | -- | .50 | -- |
| Item 28 | -- | -- | -- | -- | -- | -- | .76 | -- | -- | -- | -- | -- | -- | -- | .56 | -- |
| Item 29 | .45 | -- | -- | -- | -- | -- | -- | -- | .55 | -- | -- | -- | -- | -- | -- | -- |
| Item 30 | -- | -- | -- | -- | -- | -- | -- | .65 | -- | -- | -- | -- | -- | -- | -- | .49 |
| Item 31 | -- | -- | -- | -- | -- | -- | -- | .73 | -- | -- | -- | -- | -- | -- | -- | .69 |
| Item 32 | -- | -- | .43 | -- | -- | -- | -- | -- | -- | -- | .32 | -- | -- | -- | -- | -- |
| Item 33 | -- | -- | -- | -- | -- | -- | -- | .63 | -- | -- | -- | -- | -- | -- | -- | .73 |
| Item 34 | -- | -- | -- | -- | -- | .67 | -- | -- | -- | -- | -- | -- | -- | .68 | -- | -- |
| Item 35 | -- | -- | -- | -- | -- | -- | -- | 63 | -- | -- | -- | -- | -- | -- | -- | .61 |
| Item 36 | -- | -- | -- | -- | -- | .59 | -- | -- | -- | -- | -- | -- | -- | .55 | -- | -- |

Note. ATT = Attention/concentration; WM = Working memory; SM = Self-monitoring; TOM = Theory of mind; IMPU = Impulsivity/inhibition; PLAN = Planning/initiation; EMOR = Emotional regulation

Table 3

*Mean Scores on Each Subscale of the Self- and Other-Rating Forms of the QEF for Younger and Older Children*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Other-rating | | | | | | | | | Self-rating | | | | | | | | |
|  | All | 7 years | 8 years | 9 years | 10 years | 11 years | 12 years | 13 years | 14 years | All | 7 years | 8 years | 9 years | 10 years | 11 years | 12 years | 13 years | 14 years |
| Attention | 10.41 | 10.85 | 10.71 | 10.4 | 10.26 | 9.90 | 8.82 | 11.2 | 8.86 | 10.94 | 9.94 | 10.84 | 11.21 | 11.74 | 10.65 | 8.80 | 10.6 | 11.5 |
| WM | 6.94 | 7.41 | 7.06 | 6.89 | 6.83 | 6.17 | 6.00 | 8.20 | 6.29 | 8.45 | 7.94 | 8.01 | 7.51 | 8.05 | 7.26 | 7.37 | 8.20 | 7.50 |
| S-M | 10.96 | 12.30 | 10.95 | 9.78 | 11.13 | 10.45 | 11.00 | 10.8 | 10.43 | 10.87 | 11.88 | 11.59 | 11.44 | 12.40 | 11.09 | 10.91 | 11.4 | 10.83 |
| ToM | 7.50 | 8.21 | 7.48 | 7.18 | 7.17 | 7.66 | 7.27 | 7.20 | 6.00 | 7.98 | 7.47 | 7.83 | 7.62 | 7.60 | 7.91 | 6.15 | 7.00 | 6.33 |
| Shifting | 5.43 | 5.44 | 5.48 | 5.60 | 5.15 | 5.17 | 5.55 | 5.00 | 6.29 | 6.68 | 7.35 | 6.45 | 6.87 | 6.55 | 6.35 | 6.10 | 7.20 | 6.67 |
| Impulsivity | 10.45 | 11.14 | 11.11 | 10.17 | 10.06 | 9.62 | 8.82 | 11.00 | 9.00 | 10.81 | 10.97 | 10.87 | 10.67 | 11.02 | 11.48 | 10.60 | 12.00 | 11.17 |
| Planning | 6.64 | 6.48 | 7.01 | 6.88 | 6.72 | 6.34 | 5.27 | 5.80 | 5.86 | 8.18 | 8.21 | 7.84 | 7.65 | 7.5 | 7.00 | 6.64 | 6.80 | 6.50 |
| EmoR | 7.89 | 8.06 | 7.73 | 8.31 | 7.70 | 7.90 | 7.82 | 7.40 | 6.86 | 9.12 | 9.41 | 9.09 | 9.13 | 9.05 | 9.52 | 8.75 | 9.20 | 7.67 |
| Total | 66.22 | 69.89 | 67.52 | 65.22 | 65.02 | 63.21 | 60.55 | 66.60 | 59.57 | 73.03 | 73.18 | 72.53 | 72.10 | 73.90 | 71.26 | 65.11 | 72.40 | 68.17 |

*Note.* WM = Working memory; S-M = Self-Monitoring; ToM = Theory of mind; EmoR = Emotional regulation; Standard errors ranged from 1.43 to 5.38.

Table 4

*Positive and Negative Predictive Values for the Other-Rating Form of the QEF*

|  |  |  |
| --- | --- | --- |
|  | PPV | NPV |
| Attention/concentration (cutoff score > 11.5) | 83 | 90 |
| Working memory (cutoff score > 8.5) | 79 | 86 |
| Self-monitoring (cutoff score > 11.5) | 66 | 59 |
| Theory of mind (cutoff score > 7.5) | 66 | 65 |
| Shifting (cutoff score > 5.5) | 76 | 76 |
| Impulsivity/inhibition (cutoff score > 10.5) | 72 | 69 |
| Planning/initiation (cutoff score > 6.5) | 69 | 72 |
| Emotional regulation (cutoff score > 7.5) | 59 | 65 |
| Total scores (cutoff score > 66.5) | 83 | 72 |

*Note.* PPV = Positive predictive value; NPV = Negative predictive value

Table 5

*Positive and Negative Predictive Values for the Self-Rating Form of the QEF*

|  |  |  |
| --- | --- | --- |
|  | PPV | NPV |
| Attention/concentration (cutoff score > 10.5) | 67 | 50 |
| Working memory (cutoff score > 7.5) | 54 | 53 |
| Self-monitoring (cutoff score > 11.5) | 67 | 61 |
| Theory of mind (cutoff score > 7.5) | 71 | 68 |
| Shifting (cutoff score > 6.5) | 46 | 64 |
| Impulsivity/inhibition (cutoff score > 10.5) | 58 | 67 |
| Planning/initiation (cutoff score > 6.5) | 63 | 43 |
| Emotional regulation (cutoff score > 6.5) | 71 | 46 |
| Total scores (cutoff score > 70.5) | 75 | 64 |

*Note.* PPV = Positive predictive value; NPV = Negative predictive value

Table 6

*Partial Correlation Matrix for Each of the Subscales of Both Forms of the QEF and the Subscales of the BRIEF, DEX-C, and CHEXI*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BRIEF – Total | BRIEF – Inh | BRIEF – Shift | BRIEF – EmoC | BRIEF – Init | BRIEF – WM | BRIEF – Plan | BRIEF – Org | BRIEF – Monit | CHEXI – Total | CHEXI – WM | CHEXI – Inh | DEX-C |
| Other-Rating |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | .78\*\* | .72\*\* | .68\*\* | .52\*\* | .66\*\* | .82\*\* | .69\*\* | .79\*\* | .59\*\* | .78\*\* | .74\*\* | .77\*\* | .77\*\* |
| Attention | .61\*\* | .66\*\* | .64\*\* | .47\*\* | .53\*\* | .67\*\* | .33\*\* | .41\*\* | .38\*\* | .62\*\* | .61\*\* | .66\*\* | .65\*\* |
| WM | .59\*\* | .63\*\* | .52\*\* | .37\*\* | .64\*\* | .65\*\* | .60\*\* | .60\*\* | .47\*\* | .69\*\* | .75\*\* | .56\*\* | .55\*\* |
| S-M | .45\*\* | .53\*\* | .46\*\* | .49\*\* | .53\*\* | .43\*\* | .43\*\* | .30\* | .55\*\* | .41\*\* | .52\*\* | .41\*\* | .37\*\* |
| ToM | .33\*\* | .65\*\* | .28\* | .33\*\* | .44\*\* | .56\*\* | .61\*\* | .45\*\* | .42\*\* | .32\*\* | .34\*\* | .43\*\* | .34\*\* |
| Shifting | .50\*\* | .62\*\* | .58\*\* | .54\*\* | .41\*\* | .49\*\* | .49\*\* | .40\*\* | .33\*\* | .51\*\* | .45\*\* | .56\*\* | .56\*\* |
| Impulsivity | .42\*\* | .57\*\* | .54\*\* | .49\*\* | .39\*\* | .50\*\* | .62\*\* | .36\*\* | .48\*\* | .43\*\* | .26\* | .43\*\* | .44\*\* |
| Planning | .64\*\* | .44\*\* | .58\*\* | .48\*\* | .66\*\* | .48\*\* | .64\*\* | .62\*\* | .51\*\* | .62\*\* | .62\*\* | .53\*\* | .60\*\* |
| EmoR | .61\*\* | .39\*\* | .51\*\* | .61\*\* | .56\*\* | .57\*\* | .44\*\* | .39\*\* | .45\*\* | .48\*\* | .36\*\* | .52\*\* | .60\*\* |
| Self-Rating |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | .39\*\* | .32\*\* | .18\* | .19\* | .23\* | .22\* | .33\*\* | .26\* | .34\*\* | .39\*\* | .32\*\* | .31\*\* | .34\*\* |
| Attention | .26\* | .21\* | .20\* | .10 | .20\* | .13 | .26\* | .12 | .31\*\* | .19\* | .12 | .20\* | .23\* |
| WM | .25\* | .22\* | .19\* | .11 | .16 | .24\* | .19\* | .21\* | .23\* | .31\*\* | .27\* | .14 | .14 |
| S-M | .28\* | .27\* | .14 | .19\* | .11 | .14 | .28\* | .31\*\* | .29\* | .23\* | .30\* | .29\* | .26\* |
| ToM | .28\* | .18\* | .09 | .23\* | .26\* | .21\* | .29\* | .10 | .27\* | .18\* | .27\* | .27\* | .23\* |
| Shifting | .22\* | .18\* | .22\* | .20\* | .25\* | .19\* | .15 | .16 | .19\* | .25\* | .18\* | .14 | .21\* |
| Impulsivity | .28\* | .28\* | .08 | .14 | .19\* | .08 | .23\* | .18\* | .21\* | .25\* | .12 | .24\* | .27\* |
| Planning | .16 | .13 | .09 | .18\* | .21\* | .19\* | .17\* | .25\* | .30\* | .24\* | .14 | .11 | .13 |
| EmoR | .24\* | .24\* | .17\* | .25\* | .13 | .11 | .15 | .17\* | .22\* | .27\* | .23\* | .19\* | .24\* |

\*p < .05, \*\*p < .001

*Note.* BRIEF = Behavior Rating Inventory of Executive Function; CHEXI = Childhood Executive Functioning Inventory; DEX-C = Dysexecutive Questionnaire for Children; Inh = Inhibition; Shift = Shifting; EmoC = Emotional control; WM = Working memory; Plan = Planning; Org = Organization of Material; Monit = Monitoring; S-M = Self-Monitoring; ToM = Theory of mind; EmoR = Emotional regulation

Table 7

*Correlation Matrix for Each Subscale of Both Forms of the QEF*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Self-rating | | | | | | | | |
|  | Total | Attention | WM | S-M | ToM | Shifting | Impulsivity | Planning | EmoR |
| Other-Rating |  |  |  |  |  |  |  |  |  |
| Total | .38\*\* | .16\* | .28\*\* | .21\*\* | .25\*\* | .19\* | .22\*\* | .22\*\* | .30\*\* |
| Attention | .28\*\* | .19\* | .25\*\* | .17\* | .15\* | .12 | .13\* | .16\* | .20\*\* |
| WM | .29\*\* | .14\* | .34\*\* | .21\*\* | .12 | .16\* | .15\* | .22\*\* | .12 |
| S-M | .33\*\* | .21\*\* | .30\*\* | .27\*\* | .20\*\* | .18\* | .10 | .14\* | .20\*\* |
| ToM | .13\* | .05 | .10 | .09 | .21\*\* | .00 | .01 | .00 | .13\* |
| Shifting | .18\* | -.02 | .09 | .07 | .16\* | .21\*\* | .13\* | .15\* | .11 |
| Impulsivity | .20\*\* | .01 | .08 | .06 | .13\* | .06 | .24\*\* | .08 | .26\*\* |
| Planning | .21\*\* | .11 | .12 | .15\* | .18\* | .12 | .11 | .19\* | .05 |
| EmoR | .20\*\* | .17\* | .09 | -.01 | .06 | .14\* | .17\* | .16\* | .32\*\* |

\*p < .05, \*\*p < .001

*Note.* WM = Working memory; S-M = Self-Monitoring; ToM = Theory of mind; EmoR = Emotional regulation