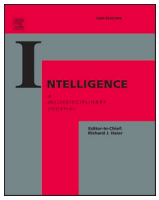
Intelligence 114 (2026) 101974

Contents lists available at ScienceDirect

Intelligence

journal homepage: www.elsevier.com/locate/intell



Review Article

Cognitive profile of individuals with borderline intellectual functioning: A systematic review

Cristina Orío-Aparicio *, Carmen López-Escribano, Cristina Bel-Fenellós

Department of Research and Psychology in Education of the Faculty of Education - Teacher Training Center of the Complutense University of Madrid, 1 Rector Royo-Villanova St., Madrid 28040, Spain

ARTICLE INFO

Keywords:
Borderline intellectual functioning
BIF
Borderline intellectual disability
Cognitive profile
Intellectual functioning
Systematic review

ABSTRACT

Borderline intellectual functioning (BIF) is defined as a neurodevelopmental condition characterised by an intelligence quotient between 71 and 85, along with difficulties in adaptive functioning. Although individuals with this condition experience various challenges and require support in different areas of life, research on this topic remains limited. Therefore, this article presents a systematic review aimed at describing the cognitive profile of individuals with BIF. The review included studies addressing the intellectual functioning of the BIF population published between 2012 and 2024. The literature search was conducted in the ProQuest, WoS, SCOPUS, and EBSCOhost databases. Finally, a total of 33 articles were included, and their quality was assessed using the SSAHS tool. The results were organised into three categories: general cognitive abilities, executive functions, language cognition, and neurophysiology. The analysis indicates that individuals with BIF exhibit a cognitive profile characterised by deficits in various domains, including executive functions (such as working memory, cognitive flexibility, processing speed, and planning), general cognitive abilities (such as memory, attention, abstract thinking, problem-solving, arithmetic, and concentration), and language-related cognitive skills, both oral and written. Additionally, neuroimaging techniques suggest that BIF is also associated with structural and functional alterations in the brain. The implications and limitations of the study are discussed, as well as the need for future research with larger samples and more comprehensive assessments. Additionally, the necessity of promoting policies and services that include this population is emphasised.

1. Introduction

The categorization of intellectual disability (ID) disorders has evolved over time. Both the definition and diagnostic criteria have changed, including IQ thresholds. This has led to categories such as borderline intellectual functioning (BIF) being pushed into the background, defined nowadays as a neurodevelopmental condition characterised by an intelligence quotient between 71 and 85, along with difficulties in adaptive functioning.

In the first half of the 20th century, BIF was classified as the highest level of ID in the *Diagnostic and Statistical Manuals of Mental Disorders* (DSM) of the American Psychiatric Association. However, since the publication of the DSM-III (1980), BIF no longer falls under the category of ID. In fact, it is not even considered a diagnostic category per se, although it is mentioned as a characteristic requiring attention.

In 1961, the American Association on Intellectual and Developmental Disability (AAIDD, formerly the American Association on Mental Deficiency) classified intellectual disability into five levels based on IQ ranges: borderline, mild, moderate, severe, and profound. The borderline category included individuals scoring approximately one standard deviation below the mean, which resulted in disproportionately high prevalence rates. Consequently, in 1973, the AAIDD removed the borderline category from the intellectual disability classification. This change was subsequently adopted by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) of the American Psychiatric Association, whereby, since the publication of the DSM-III in 1980 (American Psychiatric Association, 1980), borderline intellectual functioning (BIF) has no longer been considered part of the intellectual disability category. This redefinition effectively lowered the upper threshold for intellectual disability, excluding individuals with BIF—who, in previous decades, would have met the criteria for intellectual disability—from receiving services they genuinely required (Greenspan, 2017).

Notably, borderline intellectual functioning is not formally regarded as a diagnostic category in its own right, although it is identified as a

* Corresponding author.
E-mail addresses: crisorio@ucm.es (C. Orío-Aparicio), carmenle@edu.ucm.es (C. López-Escribano), mbel@ucm.es (C. Bel-Fenellós).

https://doi.org/10.1016/j.intell.2025.101974
Received 15 May 2025; Received in revised form 13 November 2025; Accepted 22 November 2025
Available online 25 November 2025

characteristic that requires attention. For example, in the DSM-5-TR (2022), it is listed under "Additional Conditions or Problems That May Be a Focus of Clinical Attention," while in the ICD-11 (World Health Organization, 2019), it falls under the category of "Other Specified Symptoms and Signs Relating to Cognition." In the actual manual published by the AAIDD (12th ed.; Schalock et al., 2021), BIF is not assigned to any specific category but is acknowledged as encompassing individuals who, despite not meeting the formal criteria for an ID diagnosis, share many characteristics and support needs. However, although BIF is mentioned and the importance of its correct diagnosis and differentiation from ID is highlighted, none of these manuals provide a clear and concrete definition or assessment guidelines.

Some authors have delved deeper into this topic and defined BIF as a health meta-condition requiring specific socio-health, educational, and legal support. It is characterised by a range of cognitive impairments associated with an intelligence quotient (IQ) between 71 and 85, along with adaptive functioning deficits that manifest as activity restrictions and limitations in social participation (Martínez-Leal et al., 2020; Salvador-Carulla et al., 2011). However, research on BIF remain scarce, and it is crucial to reach an agreement on what BIF is, how to assess it, and how to support this population.

Recently, Orío-Aparicio et al. (2025) published a scoping review aimed at mapping the available information on BIF A total of 138 documents were classified into different categories: intellectual functioning, adaptive functioning, additions for comprehensive evaluation, and more general articles. The present study focuses on the first of these categories: intellectual functioning.

According to the AAIDD (Schalock et al., 2021), intellectual functioning is a broader concept than intelligence. It encompasses both what is traditionally understood as intelligence—including abilities such as reasoning, planning, problem-solving, abstract thinking, comprehension of complex ideas, rapid learning, and learning from experience—and the concepts of crystallised and fluid intelligence. Additionally, the influence of other dimensions of human functioning and support systems is considered an intrinsic part of this construct. Furthermore, the DSM-5-TR (American Psychiatric Association, 2022) defines intellectual functioning as including "reasoning, problem solving, planning, abstract thinking, judgment, learning from instruction and experience, and practical understanding." The critical components identified in the manual are "verbal comprehension, working memory, perceptual reasoning, quantitative reasoning, abstract thought, and cognitive efficacy."

Following this framework, the concept of the *cognitive profile* provides a means of describing the configuration of cognitive abilities that characterise an individual's intellectual functioning. Rather than a single measure, it reflects a multidimensional pattern of strengths and weaknesses across various domains of cognition (*Jankowska et al., 2021; Pulina et al., 2019; Sajewicz-Radtke et al., 2022). In other words, a cognitive profile describes how an individual processes information, solves problems, and adapts to new or complex situations. It also helps identify distinctive cognitive patterns that may be associated with particular developmental, neurological, or genetic conditions.

Therefore, in this article, we refer to the cognitive profile as the set of characteristic features of an individual that define intellectual functioning across domains such as executive functions, memory, abstract reasoning, learning, and even neurological functioning. These features consequently have a fundamental influence on behavioural functioning, and understanding them is essential for recognising individual variability and for designing supports and interventions that build on each person's strengths while addressing their specific challenges. Furthermore, many groups of individuals with similar aetiologies share particular aspects of this cognitive profile, highlighting the importance of identifying such shared characteristics to inform targeted interventions and resources that are relevant and effective for each population group.

As far as we know, three prior literature reviews have addressed BIF intellectual functioning or cognitive profile. In 2014, Peltopuro et al. published a systematic review that included 49 articles related to BIF in general, published up until March 2012. The documents were organised into different categories: neurocognitive functioning, social behaviour, mental health, employment and marriage, risk and preventive factors. Regarding neurocognitive functioning, findings indicate that this population exhibits deficits in memory and working memory, executive functions, reading skills, and abstract thinking. Furthermore, individuals with BIF outperformed those with mild ID in most cognitive areas. However, when compared to individuals with specific learning disabilities, the BIF group obtained lower scores. The authors highlighted the need for further studies comparing individuals with BIF to populations with a similar mental age to determine whether the intellectual functioning of BIF reflects a developmental lag or a qualitatively different functioning.

Years later, Contena and Taddei (2017) published another review, this time focusing on the psychological and cognitive aspects of children and adolescents with BIF. They analysed 37 articles published between 1990 and 2014, categorising them into three descriptive groups. The first category included studies that considered BIF and mild ID as overlapping conditions. The second encompassed studies describing BIF as a feature associated with neurodevelopmental disorders. The third category examined BIF as a clinical condition characterised by an IQ ranging 71–84. It is in this last category that the cognitive features of this population are specifically addressed, suggesting that IQ may not be the most crucial factor in understanding BIF-related intellectual functioning. Instead, executive functions, such as working memory, may play a significant role in this domain.

Finally, in 2023, Stathopoulou et al. examined cognitive functioning, academic skills, and social deficits in individuals with BIF. Regarding cognitive deficits, the authors reported that this population experiences considerable difficulties in various areas, including literacy, mathematical reasoning, working memory, attention, concentration, and memory. However, although they searched for studies published between 2012 and 2022, they identified only 12 articles, and the literature review process was not based on systematic guidelines such as PRISMA, so it is unclear whether they captured all the available information.

Thus, in this systematic review, we seek to further contribute to this field of study and deepen the understanding of the intellectual functioning of the BIF population. Our article updates the existing information by incorporating the most recent studies on this topic and placing special emphasis on the cognitive domain. Additionally, we include only studies that specifically analyse BIF (without grouping it with, for example, mild ID), following the recommendations of previous reviews. With this research, our main objective is to establish the cognitive profile of BIF based on the analysis of the literature.

2. Method

2.1. Research question and objective

The research question of the current systematic review was: What are the intellectual functioning characteristics of people with BIF? Thus, the main objective was to build the cognitive profile of the population with BIF. As defined in the introduction, this cognitive profile is expected to provide information across domains such as executive functions, memory, abstract reasoning, learning, and even neurological functioning.

2.2. Design

This systematic review expands upon a previously conducted scoping review by the same authors (Orío-Aparicio et al., 2025), which adhered to the guidelines of the PRISMA-ScR (Tricco et al., 2018) and the methodological framework established by the Joanna Briggs Institute (Peters et al., 2020), and whose aim was to examine the existing body of research on borderline intellectual functioning.

In the aforementioned scoping review, relevant documents were retrieved from ProQuest, WoS, SCOPUS, and EBSCOhost, Additionally, grey literature was sourced from Google and Google Scholar to reduce publication bias and enhance the comprehensiveness of the review, including non-commercial sources such as third-sector organisations and governmental institutions. The search strategy employed included the following terms:"funcionamiento intelectual límite" OR "capacidad intelectual límite" OR "CI límite" OR "cociente intelectual límite" OR "coeficiente intelectual límite" OR "retraso mental límite" OR "borderline Intellectual functioning" OR "subaverage intellectual functioning" OR "borderline developmental disability" OR "borderline intellectual disability" OR "borderline IQ" OR "borderline learning disability" OR "borderline mental retardation" OR "minor intellectual disability". A total of 138 documents published between January 2012 and June 2024 regarding borderline intellectual functioning were included. These documents were then categorised according to the diagnostic criteria for ID established by major classification manuals (American Psychiatric Association, 2022; Schalock et al., 2021), given the absence of clear and specific criteria for borderline intellectual functioning. Three key dimensions were considered: intellectual functioning, adaptive functioning, and additional elements for a comprehensive assessment. Additionally, a category of more general documents addressing BIF from a holistic perspective was included. A detailed account of the methodology is available in the referenced article (Orío-Aparicio et al., 2025) and its prior registration on the Open Science Framework (https://osf.io/km2rp).

To address the research question of the current systematic review and understand the cognitive profile of individuals with BIF, this article will focus exclusively on studies classified under the category of "intellectual functioning."

2.3. Document selection

As previously mentioned, this article analyses only the documents categorised under the "intellectual functioning" dimension in the previous scoping review published by Orío-Aparicio et al. (2025). Accordingly, the inclusion criteria for this systematic review are as follows:

- Documents published from 2012 onwards, using as a reference point the date of the only previously published systematic review that addressed BIF in a general manner (Peltopuro et al., 2014).
- Examination of borderline intellectual functioning as a distinct group (including studies that use alternative terms such as "slow learners" or "borderline intellectual disability").
- No restrictions regarding age, gender, nationality, or other sample characteristics.
- Documents that focused primarily on, or had as their explicit objective, aspects of intellectual functioning (as defined in the introduction of this paper).
- Publications available in English or Spanish.

The three systematic reviews cited in the introduction (Contena & Taddei, 2017; Peltopuro et al., 2014; Stathopoulou et al., 2023) were excluded. Their conclusions will be compared with this study's findings in the discussion section.

The initial full-text review was conducted by the first author. The second author assessed the first half of the selected documents, while the third author reviewed the second half. An overall agreement rate of 87 % was achieved. In cases of disagreement, all three authors collaboratively re-evaluated the texts and reached a consensus. The PRISMA flow diagram illustrating the study selection process is presented in Fig. 1.

2.4. Data collection process

The data collection process followed the same procedure as the document selection, with the first author conducting the extraction and the other two authors verifying the collected data. For each document, the author and year of publication were recorded, along with its source type (e.g., research articles, conference abstract, doctoral thesis), geographic origin, study design, terminology used to refer to BIF, sample characteristics (including age and size), research objectives and key findings. No statistical data were collected due to the high variability of the data extracted from the articles included in this systematic review.

To refine the criteria and ensure a rigorous extraction of the collected information, pilot testing was conducted in which one author extracted information from a subset of articles and the other authors verified the data. The key findings were defined as those results or conclusions

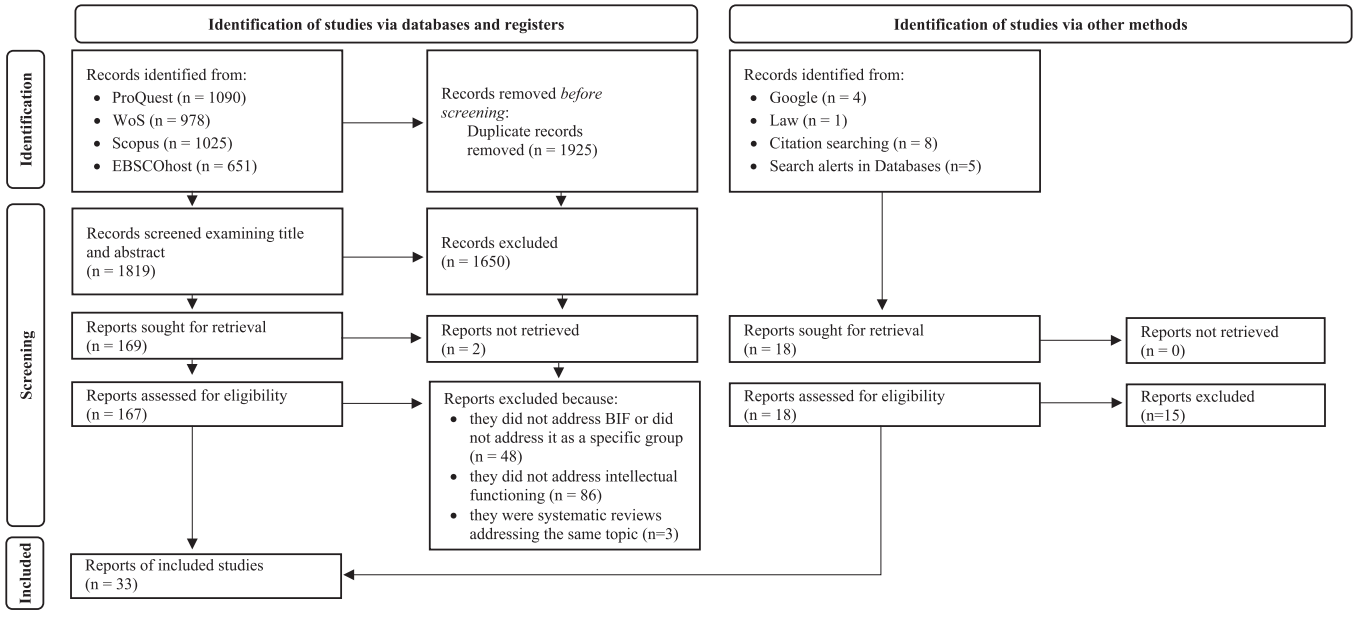


Fig. 1. Flow diagram of study selection process.
From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: https://doi.org/10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/.

directly related to the intellectual functioning of individuals with BIF.

2.5. Quality assessment

To assess the quality of the studies, we used the Scale to Evaluate Scientific Articles in Social and Human Sciences (SSAHS, López-López et al., 2019), as it is suitable for evaluating documents with different methodological designs. This scale includes eight dimensions that evaluate the title and abstract (3 items), the introduction (2 items), methodology (4 items), results (3 items), discussion (3 items), references (1 item), appendices (1 item), and document format and style (2 items). Each item is evaluated using a 5-point Likert scale, where 1 = very low quality and 5 = very high quality, yielding scores from 19 to 95. The scale demonstrated reliability ($\alpha = 0.937$) and construct validity ($V > 0.80$) and has been used in similar reviews (Muñoz Jiménez & Tamayo Ancona, 2023; Prieto Andreu, 2022; Sánchez Ceballos, 2023; Vega-Díaz et al., 2023).

The first author of this article evaluated all the documents. Subsequently, the second author evaluated one half of the documents, and the third author evaluated the other half. There was an inter-rater agreement of 72 %. There were no major discrepancies in the evaluations of each author, only minor variations in the scores assigned to each article. Consequently, the overall average score for each study was calculated.

3. Results

A brief overview of the general characteristics of the included studies is presented below. Specific information on each study can be found in Appendix I.

3.1. Quality

As observed, the majority of studies achieved ratings ranging from high to very high quality. Additionally, most of the included documents are articles published in peer-reviewed journals, presented at scientific conferences, or approved by a university, which ensures, to some extent, the reliability of their content.

3.2. Location

Regarding location, most of the papers included in this systematic review were published in Europe ($n = 22$). However, there were also studies from Latin America ($n = 5$), Asia ($n = 4$), North America ($n = 1$) and Africa (n = 1).

3.3. Document type and study design

Most of the documents were research articles. However, there was also one doctoral thesis, one project protocol, and a conference abstract. In terms of methodology, 31 documents followed quantitative paradigms. Additionally, one case study, and one mixed-methods study were identified.

3.4. Population and sample

In this article, we refer to borderline intellectual functioning (BIF). However, there is no absolute consensus within the scientific community regarding the terminology used for this group. Among the articles included in this systematic review, two used the term “borderline intelligence,” two referred to “borderline intellectual ability,” one mentioned “borderline intellectual disability,” and another used “slow learners,” defining this population with an IQ range of 70–90. The remaining 27 articles employed the term “borderline intellectual functioning,” all referring to an IQ range between 70 and 71 and 84–85.

All studies used population-based samples. The majority focused on children ($n = 11$, ages 3 to 11), adolescents ($n = 6$, ages 11 to 20), or both children and adolescents together ($n = 12$). Additionally, three studies focused on adults and one study examined a sample encompassing individuals of all ages.

3.5. Key assessment tools

Regarding the neuropsychological assessment instruments employed in the included articles, the Wechsler intelligence scales were predominantly used. Other instruments for general intelligence assessment, such as the Stanford-Binet and the KABC, were also employed, although much less frequently. The NEPSY battery appeared several times as a tool for neuropsychological assessment in children.

In the domain of executive functions, tests such as the Tower of London, the Stroop Test, and various digit span tasks were most commonly used. The BRIEF-2 was also included in one of the reviewed articles.

For the assessment of learning difficulties, reading and language batteries were employed, including instruments such as the MT Reading Battery, the DDE-2, and the TROG.

Finally, other assessment instruments were used to evaluate aspects not strictly related to intellectual functioning but nevertheless important, such as behavioural and emotional assessments, particularly the Child Behaviour Checklist (CBCL) and the Vineland Adaptive Behaviour Scales.

Appendix II provides a table specifying the tests used to collect data in each of the articles included in this systematic review.

3.6. Topic addressed

As mentioned in previous sections, the aim of this article is to construct a cognitive profile of the BIF population. The cognitive profile is a broad construct widely used in the neuropsychological field, often employed to characterise specific populations (Asensio et al., 2023; Beeldman et al., 2016; Hong et al., 2009) or to compare this measure with other constructs, such as academic performance (Nesayan et al., 2019). It can be defined as an individual’s position along various cognitive dimension continua, and its analysis enables the study of relationships between these dimensions and their impact on performance levels in learning or intellectual tasks (Letteri, 1980).

To present the main results of the studies included in this systematic review in a comprehensible manner, they have been categorised into different areas related to cognitive profile, grouping them according to the most recurring themes. Most studies ($n = 17$) take a general perspective and contribute to defining the general cognitive abilities of individuals with BIF. However, some other articles delve into more specific aspects. Six articles specifically focus on executive functions, while another five explore the cognitive aspects of language. Lastly, some studies conduct neurophysiological assessments ($n = 5$).

3.7. General cognitive abilities

In this systematic review, 17 papers were identified that broadly address the general cognitive abilities of the population with BIF. Some studies explored the relationship between cognitive performance and academic achievement. For example, Acosta Echavarria et al. (2024) examined the relationship between IQ and academic outcomes in a group of university students in Colombia. They found that 39 % of the 114 students assessed fell within the BIF IQ range (70–84) and that there was a weak positive correlation between IQ and academic performance in these students. Furthermore, they emphasised that the proportion of students classified as BIF in their sample was considerably higher than the estimated prevalence of BIF (up to 13.6 % based on the normal distribution curve; Salvador-Carulla et al., 2011). They attributed this discrepancy to cultural factors, highlighting the need for culturally adapted assessment tools. Additionally, Träff and Östergren (2021) studied cognitive development and academic skills in children with BIF.

They found that children with BIF performed worse than age-matched peers in both academic (calculation, arithmetic, problem-solving, word reading, and reading comprehension) and cognitive tasks (processing speed, executive function, cognitive flexibility, semantic fluency, phonological fluency, and visuospatial working memory). Due to the longitudinal nature of the study, they observed that while children with BIF progressed at the same rate as their peers in cognitive tasks, they developed at a slower rate in academic tasks, suggesting that their educational needs may not be adequately addressed in schools.

Other articles focused on childhood and adolescence in individuals with BIF. Alvarán et al. (2016) examined the clinical histories of children with BIF and found that the most affected cognitive processes were attention, language, and executive functions. Additionally, they identified a high comorbidity with other mental and behavioural disorders, such as ADHD, and stressed the lack of clarity in the diagnostic criteria for BIF. Contena et al. (2017) applied the Planning, Attention, Simultaneous, and Successive (PASS) theory to explore cognitive functioning in children with BIF. They identified three BIF subgroups: one with higher attention, another with better successive processing, and a third with lower overall cognitive profiles. The second group had the largest number of participants. The study also identified a specific cognitive profile for BIF, characterised by weaknesses in planning, attention, and in the verbal domain of intelligence. Similarly, Torres et al. (2018) published a protocol aimed at characterising the learning difficulties of students with BIF from a neuropsychological perspective. However, the results of this study have not yet been published.

Jankowska et al. (2014) analysed changes in WISC-R scores over time in students with BIF. They found that while verbal scale scores declined, performance scale scores improved. The authors suggested that the delayed development of verbal skills might result from chronic academic failure and insufficient educational support, whereas non-verbal skills—less dependent on formal education—tended to improve through daily life experiences. A subsequent study by some of the same authors (*Jankowska et al., 2021) used hierarchical cluster analysis and identified four distinct cognitive profiles in children with BIF: (1) children with severe verbal skill deficits but average visuospatial abilities; (2) children with short-term memory and attention deficits; (3) children with low scores in Information, Arithmetic, Digit Span, and Coding (a profile typical of learning disabilities); and (4) children with a "flat" cognitive profile, where all verbal and performance skills fell within the borderline IQ range.

Still focusing on childhood and adolescence, Pulina et al. (2019) compared the WISC-IV profiles of children with and without BIF, finding that children with BIF performed worse on all assessed measures. Additionally, while the cognitive profile of typically developing children was relatively flat, the BIF group showed significant discrepancies across the four primary index scores (verbal comprehension, perceptual reasoning, working memory, and processing speed), with the lowest scores observed in working memory. Likewise, Nitz (2022) explored which cognitive variables could predict IQ within the low average–average or the borderline intellectual functioning range. Their analyses revealed that reading comprehension ability, verbal and visual-spatial working memory can predict full-scale IQ within these ranges.

Água Dias et al. (2017) also examined the neuropsychological characteristics of children with BIF. They found that, compared to the control group, children with BIF exhibited deficits in short-term verbal and visual memory, rapid naming, and phonemic verbal fluency. Additionally, long-term verbal memory deficit was observed only in older children with BIF. The authors concluded that BIF should be studied as a distinct condition rather than in conjunction with ID. On the other hand, Ozkan et al. (2018) aimed to identify differences in cognitive characteristics, emotional regulation, and minor neurological symptoms between children with specific learning disorders and those with BIF. No significant differences were found in cognitive aspects between the two groups. However, individuals with specific learning disorders demonstrated better emotional regulation, while those in the BIF group showed greater sensory integration and motor coordination.

Smirni et al. (2019) investigated the relationship between intellectual abilities and emotional awareness in a group of adolescents with and without BIF. They found that the BIF group exhibited poorer performance in high-level cognitive domains, including executive functions and working memory. Additionally, IQ scores were negatively correlated with emotional awareness scores. However, when investigating the differences between BIF (slow learners) and gifted students in terms of critical thinking, Rofiah et al. (2022) found a significantly higher level of critical thinking in the gifted students group. Based on these findings, the authors recommend implementing strategies to enhance critical thinking skills in slow learners within educational settings.

Lastly, Blasi, Zanette et al. (2020) examined the effects of a therapy called "Movement, Cognition, and Narration of the Emotions" (MCNT) compared to standard speech therapy in children with BIF. Both interventions led to improvements in verbal memory, selective attention, planning, and language comprehension. However, MCNT proved to be more effective than standard therapy in enhancing performance IQ, social skills, and behaviour.

Considering a broader age range, Sätilä et al. (2022) examined the neurodevelopmental characteristics and daily life challenges of individuals with BIF. They identified delays in language and motor development, difficulties in executive function, delays in acquiring daily living skills, and deficits in reading, arithmetic, and abstract reasoning as key early indicators of BIF. Additionally, comorbid neuropsychiatric diagnoses were frequent, and nearly all cases required educational support.

Finally, Galletta et al. published two studies comparing cognitive abilities in adults with mental health disorders, with and without BIF. The first study examined the cognitive correlates of BIF in borderline personality disorder (Galletta et al., 2020), while the second focused on schizoid personality disorder (Galletta et al., 2024). Both studies reached the same conclusion: individuals with BIF exhibited cognitive dysfunctions in verbal and logical reasoning, attention, memory, working memory, processing speed, planning, and problem-solving. Furthermore, verbal IQ was the most discriminative factor for identifying BIF in patients with borderline or schizoid personality disorder.

In conclusion, the articles dedicated to understanding the general cognitive performance of the population with BIF show varying results, but they all agree on the difficulties observed across a wide range of related abilities, such as memory, reasoning, and comprehension. These difficulties appear to be more pronounced than those of the general population but less severe than those of individuals with mild ID.

3.8. *Executive functions*

A specific component of the cognitive profile is executive functions (EF). This term was first used by Lezak (1982), who defined it as the mental abilities essential for carrying out effective, creative, and socially acceptable behaviour. There is still no clear and universally agreed definition of executive functions within the academic community. Nevertheless, there appears to be consensus on three core components: working memory (or updating), inhibition, and cognitive flexibility (or shifting) (Friedman et al., 2016; Miyake et al., 2000). Some studies, however, propose additional components, such as processing speed, verbal fluency, and planning (Tirapu-Ustárroz et al., 2017). Although several articles in the previous section addressed the issue of executive function alongside other cognitive abilities (Alvarán et al., 2016; Sätilä et al., 2022; Smirni et al., 2019; Träff & Östergren, 2021), we have also identified five papers specifically focusing on EF.

Predescu et al. (2020) examined the differences in EF, emotion regulation, and behavioural and emotional problems among children with ADHD, BIF, and typical development. Regarding EF, they assessed only visual attention, planning, and short-term memory, finding that the typical development group outperformed both the ADHD and BIF groups in cognitive functions. However, the only significant difference between

the ADHD and BIF groups was in visual attention, with the ADHD group scoring higher.

Van Rest et al. (2021) and Erostarbe-Pérez et al. (2022) investigated EF in children and adolescents with BIF, comparing them to those with mild ID. The former found that from ages 8 to 12, children with BIF and mild ID scored similarly on cognitive flexibility and focused attention, both performing lower than their typically developing peers. However, from age 13 onwards, the scores of adolescents with BIF moved closer to those with an average IQ. A similar pattern was observed in working memory: from ages 8 to 12, children with mild ID and BIF performed at comparable levels, both below the average IQ population, but during adolescence, the three groups showed more divergent trajectories. This study provides a positive perspective on cognitive abilities in BIF, suggesting delayed rather than deficient development. Meanwhile, Erostarbe-Pérez et al. (2022) found that children with BIF performed significantly better than those with ID in various EF domains, including working memory, inhibitory control, cognitive flexibility, planning, processing speed, and verbal fluency, although their performance remained lower than that of children with typical development. Additionally, they observed a significant correlation between EF and IQ, with working memory showing the strongest association.

Two other articles focused specifically on the working memory. Stefanelli and Alloway (2020) examined the relationship between mathematical skills and working memory in students with BIF. They found that the BIF group performed significantly worse than the comparison average IQ group in both working memory and mathematical abilities. Roording-Ragetlie et al. (2022), in turn, studied the improvement in working memory caused by adaptive computerised memory training in comparison with a non-adaptive control working memory training (placebo group) in children with BIF and ADHD or ASD. However, they didn't find significant differences between groups.

Finally, Luque et al. (2015) examined the relationship between working memory, processing speed scores and learning difficulties. Their results indicated that children with BIF scored lower on the WISC-IV working memory and processing speed tests than all learning difficulty comparison groups (ADHD, reading difficulties, arithmetic difficulties), but performed better than children with mild ID. This finding suggests that within the broad classification of learning difficulties, children with BIF represent an extreme severity group, positioned close to those with mild ID.

In summary, the articles that specifically investigated executive functions also reveal a wide range of difficulties across various components of EF, such as working memory, cognitive flexibility, processing speed, planning, and inhibitory control. These difficulties once again position individuals with BIF between those with mild ID and those with an average IQ.

3.9. Language cognition area

The cognitive aspect of language is another specific component of intellectual functioning. As in the previous section, several articles previously discussed investigated different components of language cognition alongside other cognitive abilities (Água Dias et al., 2017; Alvarán et al., 2016; Jankowska et al., 2014; Sätilä et al., 2022; Träff & Östergren, 2021). However, we identified five papers specifically focused on language (both oral and written).

Di Blasi et al. (2019) studied reading fluency, accuracy, and comprehension in children with BIF or mild ID. Although they treated children with BIF and mild ID in the same way (as children with ID), they also provided some differentiated information. They found that reading acquisition difficulties were greater in children with mild ID than in those with BIF. The reading difficulty profile revealed relatively good sublexical reading but poor lexical processing, with worse reading fluency in higher grades, that is, when reading experience was greater. However, large individual differences were observed in children with both BIF and mild ID.

Muñoz-Oyarce et al. (2020) found deficits in the development of phonological awareness skills in children with BIF, which may indicate a high risk for acquiring new learning and academic performance. Later, Hesham et al. (2024) identified these same deficits. Furthermore, they found that, at the age of 6, children with BIF performed significantly lower than their dyslexic and typically developing peers. However, by the age of 8, the performance of children with BIF and those with dyslexia became comparable, although both groups still performed significantly lower than children with typical development.

Finally, Maltese et al. (2012) and Hosseini-Maasoum and Yar (2022) conducted intervention programs to enhance language skills in individuals with BIF. On the one hand, Maltese et al. (2012) aimed to assess the outcomes of a training program for dyslexia rehabilitation in a girl diagnosed with both BIF and specific learning disorder. The intervention focused on improving decoding abilities, and results showed significant improvements not only in reading decoding but also in emotional and motivational areas. On the other hand, Hosseini-Maasoum and Yar (2022) presented a case study to examine the effect of the Total Image Words Technique on the language skills of a girl with BIF. The method showed a positive effect on language skills, particularly in increasing vocabulary and comprehension.

Therefore, it can be observed that language is another weak area for individuals with BIF, particularly in relation to written language. It is crucial to consider these findings, as they may present risks or challenges in academic settings.

3.10. Neurophysiological evaluation

Although most studies on BIF have focused on cognitive aspects, understanding the underlying neurophysiological mechanisms is equally important. Neurophysiological research offers complementary evidence by directly examining how brain activity and structure relate to cognitive performance. This perspective provides a biological context for the cognitive patterns described earlier and helps clarify whether the difficulties observed in individuals with BIF reflect atypical neural processing. In this context, recent research has increasingly explored the neurophysiological correlates of BIF, aiming to identify how variations in brain function underpin the cognitive and behavioural characteristics of this population.

Therefore, while psychology and neuropsychology assess the components of information processing (e.g., attention, working memory, or executive functions) and infer brain function from them, neurophysiology directly measures brain processing through imaging techniques (Giuliano et al., 2015). The primary non-invasive methods used for this purpose include electroencephalography (EEG), positron emission tomography (PET), and functional magnetic resonance imaging (fMRI). Although these techniques differ in their approaches, they all allow for the recording of brain activity in response to an event or stimulus. Five articles included in the systematic review examined cognitive functioning from a neurophysiological perspective.

Baglio et al. (2014) compared IQ and grey matter brain volume in children with and without BIF. Their results showed that grey matter volume was strongly associated with IQ and that BIF is linked to abnormal cortical development in brain areas crucial for motor, learning, and behavioural processes. Later, Vaney et al. (2015) investigated the cognitive functioning of children with BIF using electrophysiological measures. Their findings suggest that children with BIF exhibit deficits in attentional mechanisms, information processing, stimulus discrimination, and selective attention, contributing to less efficient cognitive processing. The authors concluded that key brain systems involved in cognition and behaviour are altered in children with BIF.

Further on, Meza Salcido et al. (2019) examined the neuropsychological, psychological, and electrophysiological improvements resulting from an intervention programme for children and adolescents (aged 10 to 14) with BIF. They found significant differences in pre- and post-intervention neuropsychological and psychological assessments. In the

electrophysiological domain, notable but not statistically significant differences were observed. The authors concluded that favourable outcomes could still be achieved despite a 'late' intervention.

Finally, Blasi and colleagues published two papers exploring brain network connectivity and morphology. In the first one (Blasi, Pirastru, et al., 2020), they investigated the brain network connectivity of children with BIF exposed to adverse social environments and its relationship with intellectual functioning. Their findings revealed lower levels of brain structure integration in children with BIF compared to typically developing peers, particularly in several cortical and subcortical areas related to the limbic system. This reflects specific learning difficulties and deficits in higher-order functions. Additionally, a strong relationship between network connectivity and intellectual functioning was identified.

In the second study (Blasi et al., 2021), they analysed polymorphisms in the synaptosomal-associated protein of 25 kD (SNAP-25), which plays a role in brain functions such as synaptic plasticity, neural maturation, and neurotransmission, in children with BIF. They also examined the relationships between SNAP-25 polymorphisms, cortical thickness, and intelligence. Their results suggest a link between the presence of the rs363043(T) minor allele, represented by (CT + TT) genotypes, a reduced thickness of the left inferior parietal cortex, and lower IQ.

Therefore, it can be concluded that the difficulties presented by the population with BIF are not limited to performance but also affect the structure and functioning of the brain.

4. Discussion

The analysis of the reviewed articles suggests that individuals with BIF experience deficits in intellectual functioning across various domains (see Fig. 2). In general, deficits are reported in short-term and long-term memory (both verbal and visual), attention, logical and abstract reasoning, problem-solving, arithmetic skills, and concentration. Regarding executive functions, there seems to be a consensus that working memory is a key area of concern, along with cognitive flexibility, processing speed, and planning, all of which also present difficulties. Furthermore, the linguistic domain is affected, both in the oral and written aspects, as well as in comprehension and expression. Deficits are noted in lexical processing, reading fluency and comprehension, phonological awareness, and verbal fluency. From a neurophysiological perspective, issues are also observed in this population, with alterations in brain areas essential for cognition and behaviour. In light of these results, this paper supports the findings of previously published literature reviews that also addressed the cognitive profile of the population with BIF (Contena & Taddei, 2017; Peltopuro et al., 2014; Stathopoulou et al., 2023).

Furthermore, all these deficits appear to place individuals with BIF at a performance level between those with mild ID and those with an average IQ. In some cases, individuals with BIF experience even greater difficulties than those with specific learning disorders. This justifies and supports the need for research that differentiates this population and treats it as a distinct group (Contena & Taddei, 2017), as has been done in this systematic review, in which articles analyzing mild ID and BIF as a single group were excluded.

However, several studies report differences among subgroups within the BIF population itself. Therefore, individualised assessment is necessary to provide appropriate support for this population. Additionally, it is important to consider the context and cultural situation in which the cognitive assessment is conducted. In fact, some studies have detected significant differences in IQ scores even when assessing the same population with the same instrument but using its different versions depending on the country (Chevalier et al., 2016). This is especially important to consider when working with individuals with BIF, because a poor or insufficiently exhaustive evaluation could place them in the ID group or determine that they do not require any support based solely on their IQ.

Also for this reason, it is crucial not to overlook the assessment of adaptive functioning in these individuals, since, in addition to presenting various cognitive difficulties, they also exhibit deficits in the conceptual, social, and practical domains of adaptive skills (Orío-Aparicio, Bel-Fenellós & López-Escribano, 2025). Furthermore, society imposes certain barriers that may increase the challenges caused by these deficits. For example, the fact that access to support services is often based on IQ thresholds for intellectual disability restricts their availability to the BIF population, who, as shown in this and other studies, need these services to live a fulfilling and quality life.

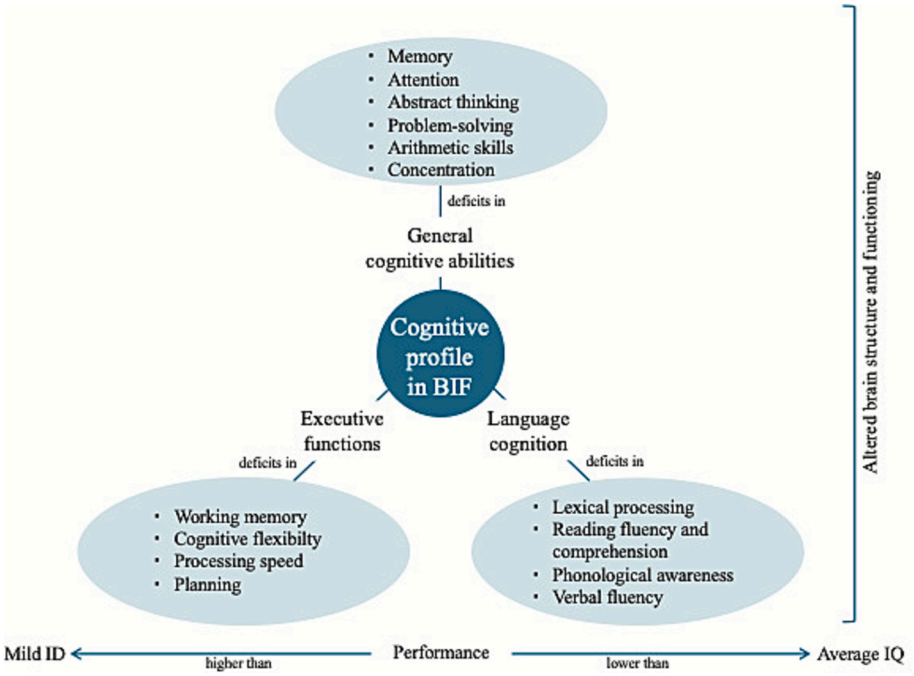


Fig. 2. Cognitive profile in BIF.

On the other hand, early detection is also a key aspect to consider. Some studies suggest that BIF may follow a model of delayed rather than deficient development (Jankowska et al., 2014; Träff & Östergren, 2021; Van Rest et al., 2021), indicating that timely intervention could help mitigate cognitive deficits. Therefore, schools play a crucial role, not only in facilitating early diagnosis but also in addressing these difficulties through targeted support, including interventions related to executive functions, explicit teaching of academic skills, and the development of social and problem-solving abilities. Such interventions could contribute to mitigating difficulties and promoting the autonomy of this population. Thus, training teachers, counsellors, and other educational professionals on BIF is essential.

At a broader level, public policies need to be established to adequately include and support this population. For example, the inclusive education system should be strengthened, ensuring personalised support in public schools from primary through post-compulsory education. Moreover, employment initiatives based on supported employment, on-the-job mentoring, or job crafting could represent valuable strategies to enhance participation and increase opportunities for social inclusion. Similarly, proper healthcare provision for individuals with BIF cannot be overlooked, particularly regarding mental health, as this population is especially vulnerable in this domain.

Although this systematic review provides a comprehensive and meticulous analysis of the published literature on the intellectual functioning of the BIF population, it also has some limitations. On the one hand, methodological differences, as well as the fact that the included studies examine highly diverse cognitive aspects have made it not possible to conduct a meta-analysis with these data. Such an analysis would have helped determine the effect size and precisely characterise the deficits in each of these cognitive abilities. On the other hand, the studies included in this review also report their own limitations, the most notable being small sample sizes that hinder the generalization of results. Additionally, other limitations were identified, such as the use of outdated assessment tools or reliance on a single instrument to evaluate complex abilities, sample selection based solely on IQ, sample heterogeneity, lack of control over variables like socioeconomic or cultural status, and methodological constraints such as the absence of control groups.

Additionally, it is important to highlight some potential biases that could affect the results of the analysed articles and, consequently, the findings of this review. For example, as previously noted, due to cultural biases in assessment tools, some instruments may produce different results in different countries, even when applied to the same population, which could affect the validity and depth of cognitive assessments. Similarly, selection biases could result in the BIF population not being fully represented, with only individuals who stand out for specific reasons (e.g., behavioural problems, mental health issues) being included in the study groups.

For all these reasons, the findings of this systematic review should be interpreted with caution. Future studies should adopt larger samples and conduct comprehensive assessments using multiple, culturally appropriate instruments to ensure reliable measures, while also considering aspects such as adaptive functioning.

5. Conclusion

This systematic review contributes to the understanding of intellectual functioning in the BIF population. The results show that individuals with BIF present a wide range of difficulties in cognitive skills, placing them between those with mild ID and those with average IQ, a position that at times may seem like a sort of limbo. Furthermore, the literature shows that these difficulties are not limited to intellectual functioning but also have repercussions on daily performance and adaptive skills (Orío-Aparicio et al., 2025).

All of this establishes a sufficiently solid theoretical foundation to recognise that individuals with borderline intellectual functioning require adequate resources and support. Policies and services that address this population are needed, as well as further research to delve deeper into this phenomenon.

CRediT authorship contribution statement

Cristina Orío-Aparicio: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Carmen López-Escribano:** Writing – review & editing, Validation, Supervision. **Cristina Bel-Fenellós:** Writing – review & editing, Validation, Supervision.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used *ChatGPT* in order to improve language and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Funding sources

This research was funded by the Ministry of Science, Innovation and Universities through the University Teacher Training Program (reference FPU2022-02193) and by the Department of Research and Psychology in Education of the Faculty of Education - Teacher Training Center of the Complutense University of Madrid.

Declaration of competing interest

The authors declare no conflicts of interest.

Appendix I

General features of the included documents.

Author (year)	Document type	Location	Study design	Diagnosis (term used)	Sample		Topic addressed	Quality
					N	Age		
Acosta Echavarria et al. (2024)	Art.	Colombia	Quant.	Borderline intelligence	$N = 114$	Adoles.	General cognitive abilities	4.95
Água Dias et al. (2017)	Art.	Portugal	Quant.	BIF	BIF = 40 TD = 40	Child. / Adoles.	General cognitive abilities	4.68
Alvarán et al. (2016)	Art.	Colombia	Quant.	Borderline intellectual ability	$N = 73$	Child. / Adoles.	General cognitive abilities	4.68

(*continued on next page*)

(*continued*)

Author (year)	Document type	Location	Study design	Diagnosis (term used)	Sample		Topic addressed	Quality
					N	Age		
Baglio et al. (2014)	Art.	Italy	Case	BIF	BIF = 13 TD = 14	Child. / Adoles.	Neurophysiological evaluation	4.58
Blasi et al. (2021)	Art.	Italy	Quant.	BIF	*N* = 33	Child.	Neurophysiological evaluation	4.74
Blasi, Pirastru, et al. (2020)	Art.	Italy	Quant.	BIF	BIF = 42 TD = 18	Child.	Neurophysiological evaluation	4.79
Blasi, Zanette et al. (2020)	Art.	Italy	Quant.	BIF	*N* = 36	Child.	General cognitive abilities	4.63
Contena et al. (2017)	Art.	Italy	Quant.	BIF	*N* = 28	Child. / Adoles.	General cognitive abilities	4.79
Di Blasi et al. (2019)	Art.	Italy	Quant.	BIF	BIF = 106 MID = 168	Child.	Language cognition area	4.74
Erostarbe-Pérez et al. (2022)	Art.	Spain	Quant.	BIF	ID = 83 BIF = 23	Adoles.	Executive Functions	4.89
Galletta et al. (2020)	Art.	Italy	Quant.	BIF	BPD + BIF = 25 BPD = 30	Adult.	General cognitive abilities	4.68
Galletta et al. (2024)	Art.	Italy	Quant.	BIF	*N* = 47	Adult.	General cognitive abilities	4.68
Hesham et al. (2024)	Art.	Egypt	Quant.	BIF	TD = 50 Dyslexic = 24 BIF + poor reading = 24	Child.	Language cognition area	4.53
Hosseini-Maasoum and Yar (2022)	Art.	Iran	Quant.	Borderline Intelligence	N = 1	Adoles.	Language cognition area	4.53
Jankowska et al. (2014)	Art.	Poland	Quant.	BIF	*N* = 30	Child. / Adoles.	General cognitive abilities	4.79
*Jankowska et al., 2021	Art.	Poland	Quant.	BIF	N = 114	Adult.	General cognitive abilities	4.58
Luque et al. (2015)	Art.	Spain	Quant.	Borderline intellectual ability	*N* = 39	Child. / Adoles.	Executive functions	4.53
Maltese et al. (2012)	Art.	Italy	Quant.	BIF	N = 1	Adoles.	Language cognition area	4.84
Meza Salcido et al. (2019)	Art.	Mexico	Quant.	BIF	N = 6	Child. / Adoles.	Neurophysiological evaluation	4.58
Muñoz-Oyarce et al. (2020)	Art.	Chile	Mix.	BIF	*N* = 37	Child.	Language cognition area	4.79
Nitz (2022)	Doct.	USA	Quant.	BIF	*N* = 109	Child. / Adoles.	General cognitive abilities	4.68
Ozkan et al. (2018)	Art.	Türkiye	Quant.	BIF	BIF = 30 SDL = 30	Child.	General cognitive abilities	4.89
Predescu et al. (2020)	Art.	Romania	Quant.	Borderline Intellectual Disability	TD = 42 ADHD = 27 BIF = 16	Child.	Executive Functions	4.68
Pulina et al. (2019)	Art.	Italy	Quant.	BIF	BIF = 204 TD = 60	Child. / Adoles.	General cognitive abilities	4.68
Rofiah et al. (2022)	Art.	Türkiye	Quant.	Slow learners (IQ 70–90)	BIF = 4 Gifted = 4	Adoles.	General cognitive abilities	4.84
Roording-Ragetlie et al. (2022)	Art.	Netherlands	Quant.	BIF	*N* = 72	Child. / Adoles.	Executive Functions	4.79
Sätilä et al. (2022)	Art.	Finland	Quant.	BIF	*N* = 651	All	General cognitive abilities	4.79
Smirni et al. (2019)	Art.	Italy	Quant.	BIF	BIF = 65 TD = 51	Adoles.	General cognitive abilities	3.95
Stefanelli and Alloway (2020)	Art.	Italy	Quant.	BIF	BIF = 85 TD = 45	Child.	Executive Functions	3.95
Torres et al. (2018)	Project protocol	Ecuador	Quant.	BIF	BIF = 730 TD = 1270	Child. / Adoles.	General cognitive abilities	4.84
Träff and Östergren (2021)	Art.	Sweden	Quant.	BIF	BIF = 27 TD =28	Child.	General cognitive abilities	4.21
Van Rest et al. (2021)	Conf. Abst.	Netherlands	Quant.	BIF	*N* = 409 (MID, BIF and Average IQ, not available how many of each group)	Child. / Adoles.	Executive Functions	4.53
Vaney et al. (2015)	Art.	India	Quant.	BIF	BIF = 19 TD = 15	Child.	Neurophysiological evaluation	4.95

Note: Art = research article; Conf. Abst. = conference paper abstract; Doct. = doctoral thesis; Quant. = quantitative; Mix. = mixed methods; TD = typical development; BPD = borderline personality disorder; MID = mild intellectual disability; SDL = specific learning disorder; ADHD = attention-deficit/ hyperactivity disorder; Child. = childhood; Adoles. = adolescence; Adult. = adulthood.

Appendix II

Key assessment tools reported in the included articles.

Author (year)	Key assessment tools
Acosta Echavarria et al. (2024)	Weschler Adult Intelligence Scale (WAIS-IV; Wechsler, 2012)
Água Dias et al. (2017)	Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 2003; Portuguese version) Coimbra Neuropsychological Assessment Battery (BANC; Simões et al., 2016)
Alvarán et al. (2016)	Wechsler Intelligence Scale for Children (WISC-IV; Weschler, 2005) Battery for developmental dyslexia and dysorthographia evaluation (DDE-2; Sartori and Job, 2007) Reading test for primary school (Cornoldi and Colpo, 1998) Developmental test of visual motor integration (VMI; Beery and Buktenica,2000) Battery for developmental dyscalculia (BDE; Biancardi and Nicoletti, 2004) Assessment of math calculation and problem solving (AC-MT 6–11; Cornoldi et al., 2005) Neuropsychological Evaluation Battery for children (BVN 5–11; Bisiacchi et al., 2005)
Baglio et al. (2014)	Test of Reception of Grammar (TROG; Bishop, 2003) Modified Barrage bell test (Biancardi and Stoppa, 1997) Tower of London (TOL; Shallice, 1982; Sannio Fancello et al., 2006) Child Behavioural Checklist (Achenbach and Rescorla, 2001, 2007). Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 2003) Magnetic resonane imaging (MRI) Assessment of the socioeconomic status (SES; Hollingshead, 2011). Wechsler Intelligence Scale for Children
Blasi et al. (2021)	MT Reading Battery (Cornoldi & Colpo 1998) Subtests of the Battery for the Assessment of Developmental Reading and Spelling Disorders (Sartori et al. 1995) Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991) Child Behavioural Checklist (CBCL 6–18; Achenbach et al., 2001)
Blasi, Pirastru, et al. (2020)	Socioeconomic Status (SES; Hollingshead, 1975) Environmental Stress Check List (ESCL, ad-hoc) Magnetic resonane imaging (MRI) Wechsler Intelligence Scale for Children- III (WISC-III; Wechsler, 2006) Movement Assessment Battery for Children (M-ABC) (Henderson and Sugden, 1992 Child Behavioural Checklist (CBCL 6–18; Achenbach and Rescorla, 2001, 2007; Achenbach, 2011) The Emotional Quotient Inventory-Youth Version (Bar-On and Parker, 2000)
Blasi, Zanette et al. (2020)	Socialization Sacle of the Vineland II (Sparrow et al., 2005) Modified Bells Test (MBT) (Biancardi and Stoppa, 1997) Tower of London (TOL; Shallice, 1982; Fancello et al., 2006) Speech Fluency tests of the Neuropsychological Evaluation Battery for developmental age 5–11 (BVN 5–11; Bisiacchi et al., 2005) Test of Reception of Grammar-2 (TROG2; Bishop, 2003; Suraniti et al., 2009) Wechsler Intelligence Scale for Children-III (WISC-III; Wechsler, 1991)
Contena et al. (2017)	Cognitive Assessment System (CAS; Naglieri & Das, 1997) Child Behavioural Checklist (CBCL 6–18; Achenbach and Rescorla, 2001, 2007; Achenbach, 2011) Wechsler Intelligence Scale for Children-III (Wechsler 1991)
Di Blasi et al. (2019)	MT Reading Battery (Cornoldi & Colpo 1998) Subtests of the Battery for the Assessment of Developmental Reading and Spelling Disorders (Sartori et al. 1995) Spanish adaptation of the WISC-IV (Wechsler, 2005) The Stroop Color and Word Test (Golden, 1994) The Five Digit Test (Sedó, 2007) Delis–Kaplan Executive Func- tion System (D-KEFS; Delis et al., 2001)
Erostarbe-Pérez et al. (2022)	Animal Sorting of NEPSY-II; Korkman et al., 2014). Mazes from WISC-R (Wechsler, 1994) Tower of London (Culbertson & Zillmer, 2006) Adaptation to Spanish of the Behaviour Rating Inventory of Executive Function – Second Edition (BRIEF-2; Gioia et al., 2017)
Galletta et al. (2020)	Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1997; Wechsler et al., 2007)
Galletta et al. (2024)	Italian version of the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First et al., 1997), Structured Clinical Interview for DSM-IV-TR Axis I Disorders Clinician Version (SCID-CV; First et al., 1996), Substance Use Module E of the SCID-I Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1997)
Hesham et al. (2024)	Stanford Binet Intelligence Scale "4th Arabic version" (Melika, 1998) Vineland Social Maturity Scale (Doll, 1965) Preschool language scale-4 (Arabic Version; Abu-Hasseba, 2011) Audiological assessment Modified Arabic dyslexia screening test (El-Fiky et al., 2016) The Arabic phonological awareness test (El-Sady et al., 2011)
Hosseini-Maasoum and Yar (2022)	Wechsler's Intelligence Test (WISC) Wineland's Social Maturity Scale Test of language development-primary (3rd) (TOLD-3; Newcomer & Hammill, 1997)
Jankowska et al. (2014)	Polish adaptation of the Wechsler Intelligence Scale for Children – Revised (WISC-R; Weschler, 1974)
*Jankowska et al., 2021	Polish adaptation of the Wechsler Intelligence Scale for Children – Revised (WISC-R; Weschler, 1974)
Luque et al. (2015)	Wechsler Intelligence Scale for Children (WISC-IV; Weschler, 2005) Reading Comprehension Test (Cornoldi & Colpo, 2001) Reading Decoding Test (Cornoldi & Colpo, 2001)
Maltese et al. (2012)	Dyslexic and Disorthographic Evaluation Test (Sartori, Job, & Tressoldi, 1995) Wechsler Intelligence Scale for Children, Revised (Wechsler, 1974) Self-Esteem Scale by the TMA (Bracken, 1992)

(*continued on next page*)

(*continued*)

Author (year)	Key assessment tools
	School Motivational Profile (Alesi, Pepi & Rappo, 2011)
	Self-Handicapping Scale for Children (Waschbusch, Craig, Pelham, & King, 2007)
	School Anxiety by the Psychiatric scales of Self-administration for children and adolescents (Cianchetti & Fancello, 2001).
	Child Neuropsychological Assessment Protocol "Puebla-Sevilla" (Solovieva et al., 2007)
Meza Salcido et al. (2019)	Evaluación de la Función Simbólica Protocol (Solovieva & Quintanar, 2014)
	Protocol for Assessing a Child's Readiness for School (Quintanar & Solovieva, 2003)
	Electroencephalogram (EEG)
Muñoz-Oyarce et al. (2020)	Prueba de Evaluación de Conciencia Fonológica (PECFO; Valera & De Barbieri, 2015)
	Kaufman Assessment Battery for Children-Second Edition (KABC-2; Kaufman & Kaufman, 2004)
Nitz (2022)	Woodcock-Johnson Test of Achievement-Fourth Edition (WJA-IV; reading comprehension; McGrew et al., 2014)
	Wechsler Intelligence Scale for Children-Fifth Edition (WISC-5; Wechsler, 2014)
	Visual Aural Digit Span Test – Form B (Koppitz, 1963)
	Gessel Figure Drawing Test
Ozkan et al. (2018)	Bender Gestalt Visual Motor (Koppitz, 1963)
	Wechsler Intelligence Scale for Children, Revised (Wechsler, 1974)
	Emotion Regulation Scale (ERS; Shields & Cicchetti, 1997)
	Neurological Evaluation Scale (NES; Heinrichs, 1988)
	Child Behaviour Checklist (CBCL; Achenbach & Rescorla, 2001)
Predescu et al. (2020)	Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997)
	Child Adjustment Scale (Santrock & Warshak, 1979)
	NEPSY (Korkman et al., 1998)
Pulina et al. (2019)	Wechsler Intelligence Scale for Children (WISC-IV; Weschler, 2005)
Rofiah et al. (2022)	Critical Thinking Scale (Facione et al., 1998)
	Spatial Span task (Automated Working Memory Assessment; AWMA; Alloway, 2007)
	Block Recall task (visuospatial STM; Pickering & Gathercole, 2001).
Roording-Ragetlie et al. (2022)	Visual Patterns Test (visual–spatial STM; Della Sala et al., 1997).
	Digit Recall task (verbal STM; Pickering & Gathercole, 2001)
	Non-Word List Recall task (verbal STM; Pickering & Gathercole, 2001)
	Backward Digit Recall (verbal WM; Pickering & Gathercole, 2001).
	Listening Recall task (verbal WM; Pickering & Gathercole, 2001).
	Neuropsychological Test for Children Finnish version (NEPSY-II; Korkman et al., 2013)
	Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III) / Wechsler Intelligence Scale for Children (WISC-IV)
Sätilä et al. (2022)	ADHD Rating Scale-IV
	Social Responsiveness Scale Finnish version (SRS)
	Strengths and Difficulties Questionnaire (SDQ-Fin).
	Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003)
	Alexithymia Questionnaire for Children (AQC; Di Trani et al., 2009)
	Benton Visual Form Discrimination Test (VFDT; Benton et al., 1983, 1994)
	Digit span forward (Monaco et al., 2013; Orsini et al., 1987)
Smirni et al. (2019)	Corsi block-tapping test forward (Lezak, 2004)
	California Verbal Learning Test (CVLT; Delis et al., 2000)
	Phonemic fluency test (Benton and Hamsher, 1989; Smirni et al., 2017)
	Digit symbol-coding (Lezak, 2004)
	Verbal and nonverbal target cancellation tasks (Mesulam, 2000)
Stefanelli and Alloway (2020)	Wechsler Objective Numerical Dimensions (WOND, Wechsler, 1996)
	Automated Working Memory Assessment (AWMA, Alloway, 2007a, 2007b)
Torres et al. (2018)	Weschler
	Test EDAH
Träff and Östergren (2021)	Raven's Standard Progressive Matrices test (Raven, 1976)
	Järpsten and Taube's word ability test (Järpsten & Taube, 1997)
Van Rest et al. (2021)	Not available
Vaney et al. (2015)	Indian adaptation of Wechsler intelligence scale for children.
	Event-related potentials (ERPs)

Note: The assessment tools have been presented exactly as they appear in the original articles from which they were extracted, including the corresponding citation.

Data availability

This review used previously published studies. Search details are in the manuscript and the Appendix table includes information on each article reviewed.

References[1]

*Acosta Echavarria, A. A., Mejía Toro, W. A., & González Uribe, A. M. (2024). IQ and academic performance in a group of first semester psychology students. *Pensamiento Americano, 15*(29), 153–167. https://doi.org/10.21803/penamer.15.29.450 (Original work published 2022).

*Água Dias, A. B., Albuquerque, C. P., & Simões, M. R. (2017). Memory and linguistic/executive functions of children with borderline intellectual functioning. *Applied Neuropsychology: Child, 8*(1), 76–87. https://doi.org/10.1080/21622965.2017.1384924

*Alvarán, L., Sánchez, D., & Restrepo-Ochoa, D. A. (2016). Neuropsicología de la inteligencia limítrofe. *Cuadernos de Neuropsicología, 10*(2), 129–141. https://dialnet.unirioja.es/servlet/articulo?codigo=6042152.

American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders (DSM-III)*. American Psychiatric Association.

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders (5th ed., text rev.)*. American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425787

Asensio, D., Fernández-Mera, A., & Duñabeitia, J. A. (2023). The cognitive profile of intellectual giftedness. *International Journal of Educational Psychology, 12*(3), 233–250. https://doi.org/10.17583/ijep.11828

*Baglio, F., Cabinio, M., Ricci, C., Baglio, G., Lipari, S., Griffanti, L., … Blasi, V. (2014). Abnormal development of sensory-motor, visual temporal and parahippocampal cortex in children with learning disabilities and borderline intellectual functioning. *Frontiers in Human Neuroscience, 8*, 806. https://doi.org/10.3389/fnhum.2014.00806

Beeldman, E., Raaphorst, J., Klein Twennaar, M., de Visser, M., Schmand, B. A., & de Haan, R. J. (2016). The cognitive profile of ALS: A systematic review and meta-

[1] The references of the documents included in this scoping review are marked with an asterisk (*) at the beginning.

analysis update. *Journal of Neurology, Neurosurgery & Psychiatry, 87*, 611–619. https://doi.org/10.1136/jnnp-2015-310734

*Blasi, V., Bolognesi, E., Ricci, C., Baglio, G., Zanzottera, M., Canevini, M. P., … Guerini, F. R. (2021). SNAP-25 single nucleotide polymorphisms, brain morphology and intelligence in children with borderline intellectual functioning: A mediation analysis. *Frontiers in Neuroscience, 15*, Article 715048. https://doi.org/10.3389/fnins.2021.715048

*Blasi, V., Pirastru, A., Cabinio, M., Tella, S. D., Laganà, M. M., Giangiacomo, A., … Baglio, F. (2020). Early life adversities and borderline intellectual functioning negatively impact limbic system connectivity in childhood: A connectomics-based study. *Frontiers in Psychiatry, 11*, Article 497116. https://doi.org/10.3389/fpsyt.2020.497116

*Blasi, V., Zanette, M., Baglio, G., Giangiacomo, A., Tella, S. D., Canevini, M. P., … Group, the B., D, B., N, P. B., E, B., M, C., A, D., Dalla, L. G., G, G., F, R. G., G, I., … R, N. (2020). Intervening on the developmental course of children with borderline intellectual functioning with a multimodal intervention: Results from a randomized controlled trial. *Frontiers in Psychology, 11*, 679. https://doi.org/10.3389/fpsyg.2020.00679

Chevalier, T. M., Stewart, G., Nelson, M., McInerney, R. J., & Brodie, N. (2016). Impaired or not impaired, that is the question: Navigating the challenges associated with using Canadian normative data in a comprehensive test battery that contains American tests. *Archives of Clinical Neuropsychology, 31*(5), 446–455. https://doi.org/10.1093/arclin/acw031

*Contena, B., Lang, M., Scandurra, V., Scordo, M. R., Storino, R., & Taddei, S. (2017). Cognitive and intellectual performance of children with borderline intellectual functioning: An explorative study. *BPA Applied Psychology Bulletin, 65*, 24–35.

Contena, B., & Taddei, S. (2017). Psychological and cognitive aspects of borderline intellectual functioning. *European Psychologist, 22*(3), 159–166. https://doi.org/10.1027/1016-9040/a000293

*Di Blasi, F. D., Buono, S., Cantagallo, C., Di Filippo, G., & Zoccolotti, P. (2019). Reading skills in children with mild to borderline intellectual disability: A cross-sectional study on second to eighth graders. *Journal of Intellectual Disability Research, 63*, 1023–1040. https://doi.org/10.1111/jir.12620

*Erostarbe-Pérez, M., Reparaz-Abaitua, C., Martínez-Pérez, L., & Magallón-Recalde, S. (2022). Executive functions and their relationship with intellectual capacity and age in schoolchildren with intellectual disability. *Journal of Intellectual Disability Research, 66*, 50–67. https://doi.org/10.1111/jir.12885

Friedman, N. P., Miyake, A., Altamirano, L. J., Corley, R. P., Young, S. E., Rhea, S. A., et al. (2016). Stability and change in executive function abilities from late adolescence to early adulthood: A longitudinal twin study. *Developmental Psychology, 52*, 326–340.

*Galletta, D., Califano, A. I., Micanti, F., Santangelo, G., Santoriello, C., & de Bartolomeis, A. (2020). Cognitive correlates of borderline intellectual functioning in borderline personality disorder. *Journal of Psychiatric Research, 130*, 372–380. https://doi.org/10.1016/j.jpsychires.2020.06.016

*Galletta, D., Santoriello, C., Califano, A., Lauria, I., & Santangelo, G. (2024). Cognitive abilities in schizoid personality disorder with and without borderline intellectual functioning: The burden in psychopathology. *Journal of Intellectual Disability - Diagnosis and Treatment, 11*(5), 214–225. https://doi.org/10.6000/2292-2598.2023.11.05.1

Giuliano, A. J., Bruder, G. E., & Seidman, L. J. (2015). Neuropsychological assessment and neurophysiological evaluation. In A. Tasman, J. Kay, J. A. Lieberman, M. B. First, & M. B. Riba (Eds.), *Psychiatry* (4th ed., pp. 597–616). https://doi.org/10.1002/9781118753378.ch37

Greenspan, S. (2017). Borderline intellectual functioning: an update. *Current Opinion in Psychiatry, 30*(2), 113–122. https://doi.org/10.1097/YCO.0000000000000317

*Hesham, S., Afsah, O., & Baz, H. (2024). Exploring phonological awareness skills in Arabic-speaking children with borderline intellectual functioning and poor Reading. *Egyptian Journal of Otolaryngology, 40*(58). https://doi.org/10.1186/s43163-024-00605-5

Hong, D., Scaletta Kent, J., & Kesler, S. (2009). Cognitive profile of turner syndrome. *Developmental Disabilities Research Reviews, 15*, 270–278. https://doi.org/10.1002/ddrr.79

*Hosseini-Maasoum, S. M., & Yar, M. (2022). The effect of total image words on linguistic recognition in children with borderline intelligence; A psycholinguistic case study. *Language Related Research, 13*, 247–284. https://doi.org/10.52547/LRR.13.2.9

*Jankowska, A. M., Bogdanowicz, M., & Takagi, A. (2014). Stability of WISC-R scores in students with borderline intellectual functioning. *Health Psychology Report, 2*, 49–59. https://doi.org/10.5114/hpr.2014.42789

**Jankowska, A. M., Łockiewicz, M., & Łada-Maśko, A. B. (2021). Heterogeneity of cognitive profiles in students with borderline intellectual functioning. *Psychiatria Polska, 55*(4), 869–885. https://doi.org/10.12740/PP/123165

Letteri, C. A. (1980). Cognitive profile: Basic determinant of academic achievement. *The Journal of Educational Research, 73*(4), 195–199. https://doi.org/10.1080/00220671.1980.10885234

Lezak, M. D. (1982). The problem of assessing executive functions. *International Journal of Psychology, 17*(2–3), 281–297. https://doi.org/10.1080/00207598208247445

López-López, E., Tobón, S., & Juárez-Hernández, L. G. (2019). Escala para Evaluar Artículos Científicos en Ciencias Sociales y Humanas- EACSH. *REICE. Revista Iberoamericana Sobre Calidad, Eficacia Y Cambio En Educación, 17*(4), 111–125. https://doi.org/10.15366/reice2019.17.4.006

*Luque, D. J., Elósegui, E., & Casquero, D. (2015). Análisis del WISC-IV en una muestra de alumnos con Capacidad Intelectual Límite. *Revista De Psicología, 23*(2). https://doi.org/10.5354/0719-0581.2014.36145

*Maltese, A., Rappo, G., Fratantonio, A., & Pepi, A. (2012). An analysis of a single case of comorbidity between learning disability and borderline intellectual functioning. In *Procedia—Social and behavioural sciences 69 3rd international conference on education and educational psychology (ICEEPSY)* (pp. 2046–2053). Turkey: CL-Istanbul. https://doi.org/10.1016/j.sbspro.2012.12.163.

Martínez-Leal, R., Folch, A., Munir, K., Novell, R., Salvador-Carulla, L., & Borderline Intellectual Functioning Consensus Group. (2020). The Girona declaration on borderline intellectual functioning. *The Lancet Psychiatry, 7*(3), Article e8. https://doi.org/10.1016/S2215-0366(20)30001-8

*Meza Salcido, L. E., García Flores, M. A., Pelayo González, H. J., et al. (2019). Efectos neuropsicológicos, psicológicos y en la actividad eléctrica cerebral de un programa interventivo en sujetos con funcionamiento intelectual límite. *Panamerican Journal of Neuropsychology, 13*(1), 99–115. https://www.redalyc.org/articulo.oa?id=439667308010.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49–100.

Muñoz Jiménez, W., & Tamayo Ancona, M. E. (2023). Efectos del aula invertida en el rendimiento académico en cursos de Física: una revisión sistemática. *EDMETIC: Revista de Educación Mediática y TIC, 12*(2). https://doi.org/10.21071/edmetic.v11i1.16062

*Muñoz-Oyarce, M. F., Monzalve-Macaya, M., Almonacid-Fierro, A., & Merellano-Navarro, E. (2020). Nivel de conciencia fonológica en estudiantes con funcionamiento intelectual limítrofe. *Avances en Psicología Latinoamericana, 38*(2), 1–14. https://doi.org/10.12804/revistas.urosario.edu.co/apl/a.7704

Nesayan, A., Amani, M., & Asadi Gandomani, R. (2019). Cognitive profile of children and its relationship with academic performance. *Basic and clinical neuroscience, 10*(2), 165–174. https://doi.org/10.32598/bcn.9.10.230

*Nitz, J. Z. (2022). *Do reading comprehension, verbal working memory and visual–spatial working memory predict borderline intellectual functioning in English language learners? [doctoral thesis]*. Capella University.

Orío-Aparicio, C., Bel-Fenellós, C., & López-Escribano, C. (2025). Understanding adaptive skills in borderline intellectual functioning: A systematic review. *European Journal of Investigation in Health, Psychology and Education, 15*(3), 40. https://doi.org/10.3390/ejihpe15030040

Orío-Aparicio, C., López-Escribano, C., & Bel-Fenellós, C. (2025). Borderline Iitellectual functioning: A scoping review. *Journal of Intellectual Disability Research, 69*, 437–456. https://doi.org/10.1111/jir.13221.

*Ozkan, S., Kara, K., Almbaideen, M., & Congologlu, M. A. (2018). Investigation of distinctive characteristics of children with specific learning disorder and borderline intellectual functioning. *Archives of Clinical Psychiatry (São Paulo), 45*, 1–6. https://doi.org/10.1590/0101-60830000000145

Peltopuro, M., Ahonen, T., Kaartinen, J., Seppälä, H., & Närhi, V. (2014). Borderline intellectual functioning: A systematic literature review. *Intellectual and Developmental Disabilities, 52*, 419–443. https://doi.org/10.1352/1934-9556-52.6.419

Peters, M. D. J., Marnie, C., Tricco, A. C., Pollock, D., Munn, Z., Alexander, L., … Khalil, H. (2020). Updated methodological guidance for the conduct of scoping reviews. *JBI Evidence Synthesis, 18*(10), 2119–2126. https://doi.org/10.11124/JBIES-20-00167

*Predescu, E., Sipos, R., Costescu, C. A., Ciocan, A., & Rus, D. I. (2020). Executive functions and emotion regulation in attention-deficit/hyperactivity disorder and borderline intellectual disability. *Journal of Clinical Medicine, 9*(4), 986. https://doi.org/10.3390/jcm9040986

Prieto Andreu, J. M. (2022). Revisión sistemática sobre la evaluación de propuestas de gamificación en siete disciplinas educativas. *Teoría de la Educación. Revista Interuniversitaria, 34*(1), 189–214. https://doi.org/10.14201/teri.27153

*Pulina, F., Lanfranchi, S., Henry, L., & Vianello, R. (2019). Intellectual profile in school-aged children with borderline intellectual functioning. *Research in Developmental Disabilities, 95*(103). https://doi.org/10.1016/j.ridd.2019.103498

*Rofiah, N. H., Barida, M., Widyastuti, D. A., Hartanto, D., Handayani, T., Saputra, W. N. E., … Sari, P. (2022). Critical thinking ability among gifted and slow learner students in higher education. What is the recommended learning model? *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 13*(2), 26–30. https://doi.org/10.17762/turcomat.v13i2.12116

*Roording-Ragetlie, S., Spaltman, M., de Groot, E., Klip, H., Buitelaar, J., & Slaats-Willemse, D. (2022). Working memory training in children with borderline intellectual functioning and neuropsychiatric disorders: A triple-blind randomised controlled trial. *Journal of Intellectual Disability Research, 66*, 178–194. https://doi.org/10.1111/jir.12895

Sajewicz-Radtke, U., Jurek, P., Olech, M., Łada-Maśko, A. B., Jankowska, A. M., & Radtke, B. M. (2022). Heterogeneity of cognitive profiles in children and adolescents with mild intellectual disability (MID). *International Journal of Environmental Research and Public Health, 19*(12), 7230. https://doi.org/10.3390/ijerph19127230

Salvador-Carulla, L., Ruiz Gutiérrez-Colosia, M., & Nadal Pla, M. (2011). *Manual de Consenso sobre Funcionamiento Intelectual Límite (FIL)*. Fundación Æquitas.

Sánchez Ceballos, L. A. (2023). Contribuciones de las funciones ejecutivas sobre los procesos emocionales: una revisión sistemática. *Psicoespacios, 17*(31). https://doi.org/10.25057/21452776.1527

*Sätilä, H., Jolma, L. M., & Koivu-Jolma, M. (2022). Children, adolescents, and young adults with borderline intellectual functioning: Etiological, neurophysiological, and MRI findings in a cohort of 651 patients. *Neurology International, 14*(4), 1007–1017. https://doi.org/10.3390/neurolint14040080

Schalock, R. L., Luckasson, R., & Tassé, M. J. (2021). Intellectual disability: Definition, diagnosis. In *Classification, and Systems of Supports* (12th ed.). AAIDD.

*Smirni, D., Smirni, P., Di Martino, G., Operto, F. F., & Carotenuto, M. (2019). Emotional awareness and cognitive performance in borderline intellectual functioning young adolescents. *Journal of Nervous and Mental Disease, 207*, 365–370. https://doi.org/10.1097/NMD.0000000000000972

Stathopoulou, A., Papaioannou, G. L., & Driga, A. M. (2023). Borderline intelligence, academic and social emotional development: The role of ICTs. *World Journal of Advanced Research and Reviews, 18*, 889–900. https://doi.org/10.30574/wjarr.2023.18.3.1145

*Stefanelli, S., & Alloway, T. P. (2020). Mathematical skills and working memory profile of children with borderline intellectual functioning. *Journal of Intellectual Disabilities, 24*(3), 358–366. https://doi.org/10.1177/1744629518821251

Tirapu-Ustárroz, J., Cordero-Andrés, P., Luna-Lario, P., & Hernáez-Goñi, P. (2017). Propuesta de un modelo de funciones ejecutivas basado en análisis factoriales. *Revista de Neurologia, 64*, 75–84.

*Torres, M. L., Martínez Suárez, P., Jara Saldaña, G., García Guevara, W., Cedillo Armijos, M. L., & Jaramillio Ortiz, F. (2018). Proyecto PHI: Funcionamientointelectual límite o extremo inferior y dificultades de aprendizaje. *Archivos Venezolanos de Farmacología y Terapéutica, 37*(5). http://repositorio.ikiam.edu.ec/jspui/handle/RD_IKIAM/289.

*Träff, U., & Östergren, R. (2021). Development of cognitive functions and academic skills in 9- to 10-year-old children with borderline intellectual functioning. *Developmental Neuropsychology, 46*(1), 54–69. https://doi.org/10.1080/87565641.2020.1858421

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine, 169*, 467–473. https://doi.org/10.7326/M18-0850

*Van Rest, M., Matthys, W., Van Nieuwenhuijzen, M., & Schuengel, C. (2021). Deficit or delay? Executive functions in 8-to 17-year-olds with borderline intellectual functioning. *Journal of Intellectual Disability Research, 65*(8), 711. https://research.vu.nl/en/publications/deficit-or-delay-executive-functions-in-8-to-17-year-olds-with-bo.

*Vaney, N., Khaliq, F., & Anjana, Y. (2015). Event-related potentials study in children with borderline intellectual functioning. *Indian Journal of Psychological Medicine, 37*(1), 53–57. https://doi.org/10.4103/0253-7176.150820

Vega-Díaz, M., González-García, H., & de Labra, C. (2023). Influence of parental involvement and parenting styles in children's active lifestyle: A systematic review. *PeerJ, 11*, Article e16668. https://doi.org/10.7717/peerj.16668

World Health Organization. (2019). *International statistical classification of diseases and related health problems* (11th ed.) https://icd.who.int/.