



# Treatment, Education, and Prognosis of Slow Learners (Borderline Intelligence)

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**Objectives:** Borderline intelligence has been excluded from formal diagnostic systems and not included in disability diagnoses, leaving gaps in treatment, education, and social welfare despite various functional impairments. Therefore, we aimed to shed light on ways to enhance the intelligence and functioning of individuals with borderline intelligence by reviewing research on its progression, education, and treatment.

**Methods:** Ten studies that met the inclusion and exclusion criteria were included in the final literature review and analyzed according to detailed topics (participant characteristics, design, and results).

**Results:** Borderline intelligence is associated with various comorbid conditions, such as anxiety, depression, attention deficit/hyperactivity disorder, and addictive disorders, which negatively impact its course and prognosis. Individuals with borderline intelligence often face challenges in academics, employment, interpersonal relationships, and health owing to lifelong cognitive impairments. The treatment of borderline intelligence necessitates addressing environmental factors, such as neglect and abuse, as well as treating comorbid mental disorders, which are crucial for prognosis. Tailoring treatment programs for cognitive profile characteristics have been proposed, and studies have reported the effectiveness of pharmacotherapy, working memory training, and intensive rehabilitation training. Therefore, early intervention during childhood brain development is necessary. Risk factors, such as lack of parental education, and their impact on treatment outcomes have also been reported.

**Conclusion:** Extensive research is needed on education, treatment, and prognosis related to borderline intelligence. Active intervention for children with borderline intelligence is essential to improve their functioning and quality of life.

**Keywords:** Borderline intelligence; Treatment; Education; Prognosis.

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## INTRODUCTION

Borderline intelligence refers to a state where intelligence on cognitive tests falls below average but does not reach the level of intellectual disability (in the range of 71–84) [1]. Borderline intelligence is known to impair academic performance and negatively affect judgment, social functioning, and employment in adulthood [2]. It can also be accompanied by various neurodevelopmental issues during growth and can lead to mental health problems, such as anxiety, depression, personality disorders, and suicide in adulthood. Despite its significant lifelong impact on individuals and prevalence in approximately 12% of the population [3], borderline intelligence is currently not classified as a disorder based on diagnostic criteria and is not recognized as a disability, leaving it in a blind spot for treatment, education, and social welfare

support [4].

Borderline intelligence can be considered a highly heterogeneous group with diverse characteristics [2]. The diverse causes include genetic factors, prenatal complications, and environmental factors that disrupt intellectual development (such as abuse, neglect, and maternal stress). Cognitive profiles also vary across individuals with borderline intelligence, with research suggesting that different types can be identified based on the cognitive domains that show impairment [5].

Compared with severe intellectual disability, mild intellectual disability or borderline intelligence may benefit more from education. However, research on education or treatment for borderline intelligence is less abundant than that on the general population or intellectual disabilities, and its progression and prognosis are not understood adequately. Additionally, enhancing the functioning of individuals with borderline intelligence can be achieved through the appropriate treatment of comorbid conditions. Conversely, there is a risk of overlooking or neglecting the consideration of borderline intelligence

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in treatment despite addressing comorbid conditions.

Therefore, this study reviews the relevant literature on the progression, education, and treatment of individuals with borderline intelligence. Thus, it attempts to identify ways to enhance their intelligence and functioning, providing valuable insights for them to integrate into society and live fulfilling lives.

## METHODS

This study reviewed the research on the progression, education, and treatment of children, adolescents, and adults with borderline intelligence. The interventions included randomized controlled trials (RCTs) and non-RCTs. The search terms included “borderline intelligence” and either “progression,” “education,” or “treatment.”

A total of 62 studies were initially selected, and 52 studies were subsequently excluded (that did not match in terms of participant characteristics, design, or results), resulting in the final selection of 10 studies.

## RESULTS

### Progression and prognosis of borderline intelligence

The prognosis of borderline intelligence was influenced by co-occurring mental disorders. Borderline intelligence is commonly associated with mental disorders [2], such as anxiety, depression, and conduct disorders. As individuals transition into adolescence and adulthood, it has been reported to be associated with antisocial personality disorder, psychosis, suicide, and substance abuse [6].

Furthermore, individuals with borderline intelligence experience lifelong difficulties in academic and occupational settings, cannot often engage in high-income occupations, and have poor health statuses. Children with borderline intelligence exhibit high rates of academic failure and school maladjustment due to difficulties with motor skills and cognition [2]. Research has shown delayed development in brain regions crucial for behavioral, learning, and motor abilities such as the parahippocampal, temporal, and sensorimotor cortices [7].

Borderline intelligence is associated with impaired performance on Theory of Mind tests, indicating delayed development of interpersonal competence [8]. Their ability to understand the desires, thoughts, and intentions of others is diminished, resulting in social ineptitude and lifelong challenges in social interactions as adults.

### Education and treatment of borderline intelligence

Education and treatment for borderline intelligence should

consider the underlying conditions or factors causing borderline intelligence, comorbidities, and cognitive impairment profiles.

### Modifying underlying conditions

Treatment should focus on the underlying conditions if they are treatable or factors that can be modified [2]. If the underlying cause of borderline intelligence is a treatable condition or factor that can be addressed, emphasis should be placed on addressing it. If the cause is genetic or prenatal complications leading to impaired brain development or brain injury, it may be an irreversible condition. Efforts should be made toward rehabilitation programs aimed at maximizing the remaining abilities. Nevertheless, if the cause is environmental deprivation (such as neglect, abuse, or maternal depression), adjusting the environment is necessary to normalize intelligence development, especially in younger individuals, because environmental adjustments are likely to have a significant impact on prognosis.

### Treatment of comorbidities

If comorbid conditions, such as attention deficit/hyperactivity disorder (ADHD), depressive disorders, or conduct disorders, are present, appropriate treatment can influence an individual's functional level. In some cases, treating comorbid conditions may have a positive impact on intelligence. For example, if there is a specific impairment in working memory (WM), appropriately treating ADHD may lead to improvements in learning, occupational functioning, and intelligence. Treating depression in cases where processing speed is particularly impaired may yield similar effects. The same applies to language comprehension difficulties, in which speech therapy may lead to positive outcomes. If subtest scores on intelligence tests show an imbalance, considering the possibility of comorbid mental disorders and providing appropriate treatment for diagnosable mental disorders may improve overall progression and prognosis and alter intelligence itself.

Three independent placebo-controlled studies have validated the efficacy of methylphenidate (MPH) treatment in children with borderline or mild intellectual disability accompanied by ADHD [9]. The results showed efficacy compared to placebo, although the treatment effects were relatively diminished with lower intelligence levels. The studies administered medication or placebo for 24 weeks and measured the outcomes using teacher and parent ratings on standardized behavioral scales, performance on computer-controlled cognitive-motor tests, and measures of cardiovascular responses. The results indicated improvements in attention, overactivity, and conduct problems based on teacher and par-

ent evaluations. MPH also improved the accuracy in some cognitive assessments, increased the reaction speed, and slightly increased the heart rate.

Moreover, in cases where individuals are dependent on various addictive substances or behaviors, treatment is crucial as these dependencies can have negative effects on brain development. Particularly in children, co-occurring addictive disorders can hinder exposure to environments that promote brain development. Behavioral therapy, including close monitoring by parents and environmental adjustments, is essential for the treatment of addictive disorders in children.

A review investigated the effectiveness of Seeking Safety therapy in individuals with borderline intelligence or mild intellectual disability who also had post-traumatic stress disorder (PTSD) or substance use disorder (SUD) [10]. This study found no integrated approach to the treatment of PTSD and SUD. PTSD is mainly treated using eye movement desensitization and reprocessing (EMDR) and cognitive behavioral therapy, whereas SUD is primarily treated using cognitive behavioral therapy and mindfulness. This study proposes tools for evaluating communication, structure, nonverbal elements, networks, coping skills, therapeutic relationships, and treatment progress in individuals with borderline intelligence or mild intellectual disability, PTSD, or SUD.

#### **Training for cognitive and socioemotional function**

Additionally, a double-blind, RCT compared the effectiveness of WM training with and without personalized coaching in children with borderline intelligence or mild intellectual disability and comorbid neuropsychiatric disorders, such as ADHD and/or autism spectrum disorder (ASD) [11]. Both groups showed improvements in various indicators, but no significant differences were observed. Cogmed WM was conducted at home or school for 8 weeks, 4 days a week, for 30 minutes per day. One group received active coaching and feedback based on individual performance, whereas the other group received general, non-personalized coaching. Both groups underwent pre- and post-intervention assessments of executive functioning, academic achievement, and several behavioral measurements with a follow-up assessment at 6 months. This study demonstrated that consistent, structured treatment, regardless of individualized coaching, can improve neurodevelopmental task performance.

One study classified borderline intelligence into different types based on cognitive profiles using the revised Wechsler Intelligence Scale for Children. A hierarchical cluster analysis revealed four distinct cognitive profiles: children with severe verbal skill deficits and average visual-spatial abilities; children with short-term memory (STM) and attention deficits; children with a typical profile for learning disabilities

(ACID profile); children with a “flat” cognitive profile where all verbal and performance skills were on a borderline intelligence quotient (IQ) level [5]. The authors suggest that when designing educational and developmental interventions for children, it is crucial to consider their cognitive impairment profiles. Programs should be tailored to address and improve these cognitive deficits.

A computerized WM training program focusing on memory, response inhibition, fluid intelligence, scholastic abilities, and story recall was effective in adolescents with mild or borderline intellectual functioning [12]. Participants were randomly assigned to either a training group adapted to each child’s progress in WM, a nonadaptive WM training group, or a control group. Results from the pre-test, post-test, and follow-up assessments showed that the adaptive training group exhibited significantly improved verbal STM compared to the control group. Both adaptive and non-adaptive WM training groups showed greater improvements in visual STM, arithmetic, and story recall at follow-up assessments than at post-test, indicating continued progress. The non-adaptive training group also showed an increased visuospatial WM capacity.

A multicenter, interventional, single-blind, randomized controlled study was conducted to verify whether intensive rehabilitation training was more effective than standard speech therapy [13]. This intensive rehabilitation training, known as the movement, cognition, and narrative of emotions (MCNT), is based on three theories: intelligence is not one-dimensional or fixed; rather, the development of emotion, cognition, and motor skills is interconnected, and environmental stimuli that promote brain development have a significant impact. Elementary school students with borderline intelligence, multiple learning disabilities, and behavioral problems were enrolled in this study. The standard speech therapy group received 45-minute sessions twice a week for nine months, while the MCNT group received three-hour sessions five days a week in small groups for the same duration. The results showed that MCNT was more effective than conventional speech therapy in improving full-scale IQ, performance IQ, socialization abilities, and behavior; however, motor abilities did not improve. Both treatments improved verbal memory, selective attention, planning, and language comprehension; however, the conventional speech therapy group showed significantly worse behavior. This study indicates that intensive and multimodal treatment is more effective than single-domain treatment in improving intellectual, adaptive, and behavioral functioning in children with borderline intelligence. The authors also suggested that early therapeutic intervention could have positive effects on brain development, potentially helping overcome vulnerabilities to mental disorders in adulthood.

One study examined the effectiveness of Social Competence Training in adolescents with borderline intellectual functioning [14]. Participants were randomly assigned to the intervention and control groups, and the results showed improvement in the intervention group, particularly in social problem-solving and achievement of individual behavioral goals in everyday life. Nonetheless, no intervention effects were observed for problem-solving competence and skills in standardized role-play.

### Parental training

Another study aimed to identify the risk factors influencing parental training dropout and treatment outcomes [15]. Parent-child interaction therapy (PCIT) was conducted with families of approximately 50-month-old children exhibiting externalizing behavioral problems, developmental delays, or borderline developmental delays. PCIT is an evidence-based parent-trained behavioral therapy conducted in hospital outpatient clinics. Cumulative risk, calculated from various risk factors, including socioeconomic disadvantage, family structure, and maternal risk characteristics, was used as an indicator. Families with three or more risk factors were more likely to drop out and showed a poor treatment response, whereas minority status and family structure predicted dropout. Maternal education predicts poor treatment outcomes when used as a single risk factor.

## DISCUSSION

Borderline intellectual functioning has been excluded from formal diagnostic criteria, resulting in a lack of research on related outcomes, education, and treatment programs [4]. Despite this scarcity, existing studies indicate that borderline intellectual functioning persists throughout life owing to delays in early brain development, resulting in disadvantages in academic, occupational, interpersonal, health, and quality of life aspects [2]. Moreover, high comorbidity of neurodevelopmental and mental disorders negatively affects the course and prognosis of borderline intellectual functioning [6].

In the education and treatment of borderline intellectual functioning, environmental factors, particularly those contributing to child abuse, neglect, and maternal depression, require early adjustment to promote environments that foster brain development and intelligence. Additionally, appropriate treatment is crucial when other mental disorders, such as anxiety, depression, ADHD, PTSD, and SUD, are present alongside borderline intellectual functioning. Medication therapy with MPH has been reported to be effective for children with borderline intellectual functioning and comorbid ADHD, although its efficacy decreases with lower intelligence

[8]. For children with borderline intellectual functioning with comorbid ADHD and ASD, WM training was effective regardless of the presence of individual coaching, and no significant difference was found [11]. Consistent and structured programs showed significant improvements, indicating that these programs led to significant improvements.

Early intervention in children with borderline intellectual functioning is recommended to positively affect the developing brain. As cognitive profiles vary based on areas of impairment, such as language, spatial abilities, and attention, tailored intervention programs are essential [5]. Additionally, intensive rehabilitation training, encompassing movement, cognition, and emotional narration, has been found to be more effective than conventional language therapy in children with borderline intellectual functioning [12]. Factors contributing to parental education dropout and treatment outcomes include socioeconomic disadvantages, family structure, and maternal risk characteristics [13].

Future research should focus on developing early intervention programs to enhance the functioning and prognosis of children with borderline intellectual function.

## CONCLUSION

A review of studies has demonstrated that borderline intellectual functioning negatively affects individuals' academic, occupational, and social functioning, despite not being diagnosed as a disorder in the psychiatric domain. Furthermore, environmental adjustments for developing children, treatment of comorbid conditions, and early interventions appear to be effective.

### Availability of Data and Material

Data sharing not applicable to this article as no datasets were generated or analyzed during the study.

### Conflicts of Interest

The author has no potential conflicts of interest to disclose.

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